5-2018

ANALYZING COLLEGE STUDENTS' PERCEPTIONS OF THE DAIRY INDUSTRY THROUGH A DAIRY FARM VISIT: A CONVENIENCE SAMPLE APPROACH

Erin Nicole Allen
University of Tennessee

To the Graduate Council:

I am submitting herewith a thesis written by Erin Nicole Allen entitled "ANALYZING COLLEGE STUDENTS' PERCEPTIONS OF THE DAIRY INDUSTRY THROUGH A DAIRY FARM VISIT: A CONVENIENCE SAMPLE APPROACH." I have examined the final electronic copy of this thesis for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Master of Science, with a major in Agricultural Leadership, Education and Communications.

Joseph L. Donaldson, Major Professor

We have read this thesis and recommend its acceptance:

Gina M. Pighetti, Carrie A. Stevens

Accepted for the Council:
Dixie L. Thompson

Vice Provost and Dean of the Graduate School

(Original signatures are on file with official student records.)

ANALYZING COLLEGE STUDENTS' PERCEPTIONS OF THE DAIRY INDUSTRY THROUGH A DAIRY FARM VISIT: A CONVENIENCE SAMPLE APPROACH

A Thesis Presented for the
Master of Science
Degree
The University of Tennessee, Knoxville

Erin Nicole Allen
May 2018

ABSTRACT

Potentially due to a lack of trust and limited communication between farmers and consumers, there is an issue of consumer misinformation about the dairy industry. Consumer perception is negatively impacting the industry and hurting dairy farmers across the country. Agritourism and dairy farm visits have had limited study. From the standpoint of consumer perception, today's college students make up an intriguing study population. This generation, Generation Z, is in the process of developing their buying behaviors; they will eventually make up a significant portion of consumers with a great deal of buying power (Priporas, Stylos & Fotiadis, 2017). The purpose of this study was to analyze college students' perceptions of the dairy industry before and after visiting an operating dairy farm to see if their perceptions changed, if at all. The objectives for the study include a comparison of participants' perceptions of herd health, dairy regulations, and farm practices prior to and after the farm visit. The researcher also sought to evaluate participants' satisfaction with the dairy farm visit. An instrument was created to align with prior research and the study objectives. The instrument was validated by an expert panel and found to be reliable through pilot testing. A convenience sample of participants (N=8) was recruited from the History of Food course at the University of Tennessee. Participants completed a pretest before the dairy farm visit and a posttest afterwards. This dairy farm visit included a tour, lecture, and opportunities to ask dairy farmers questions. The results from comparing the pretest/posttest perceptions suggest that the dairy farm visits had a positive impact on the participants' perceptions of the dairy industry. Almost 90% of the participants agreed when asked if: this dairy visit motivated them to buy more dairy products, they were taught something new on the visit, and the visit made them perceive the dairy industry more positively. Recommendations include the need to provide consumers with dairy farm visits that are scheduled at more convenient times and that include an intentional educational experience.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER ONE

INTRODUCTION AND GENERAL INFORMATION

Today, farm and ranch families make up less than two percent of the population in the United States of America. The average American is at least three generations removed from the farm, and these demographics have contributed to a disconnect of information between farmers and consumers ("Our Food Link", 2018). Consumer perceptions of agriculture have been studied from several perspectives over the past 25 years, including consumers' farm experience or a lack thereof; animal well-being and ethical treatment of livestock (Weber, Hoban, Kendall & Bull, 1995); food nutrition and safety (Reed, 2015); and how new technologies may impact agriculture (Weber, Hoban, Kendall & Bull, 1995; Clark & Ohkawa, 2005).

Barkema (1993) found that consumers showed concerns with how their food was raised and the nutritional effects of consuming specific foods. In a 1995 study, consumers expressed strong concerns that technology had numerous negative effects on agriculture. The researchers postulated that these consumer concerns were the result of consumers being at least one generation removed from having experience on farms and ranches (Weber, Hoban, Kendall & Bull, 1995). This finding was echoed in a study of consumer perceptions regarding crop production and pesticide usage which found that consumers with no prior farm experience expressed both concerns about food safety and an overall lack of information regarding the safety of production practices (Clark & Ohkawa, 2005).

Consumer perceptions may have negatively affected the dairy industry, especially dairy producers (Ventura, 2015). Fluid milk consumption in the United States peaked in 1985 at 227 pounds per person and has been gradually decreasing over the years. The low in 2016 was measured at being 154 pounds of fluid milk consumed per person (USDA Economic Research Service, 2018). One of the largest challenges for the dairy industry is the divide between public perceptions and industry practices, causing less public trust (von Keyserkingk, 2013). Wolf (2016), studied over 2,500 American consumers and farmers and found that 63% of respondents were concerned with dairy cattle welfare and perceived that dairy farmers had the largest impact on dairy cow welfare.

While research has documented the challenges associated with public's perception of the dairy industry research has provided limited solutions for addressing the challenges. Yet, dairy farm visits may offer an opportunity for educating consumers. Farm visits and agritourism activities have become increasingly popular in recent years. A main goal of farmers choosing to participate in farm visits is to properly educate the public about farming (Tew & Barbieri, 2012). However, one self-led farm visit study surveyed consumers before and after touring a dairy farm, and the results suggested that consumers still had concerns surrounding cow-calf separation and access to the outdoors (Ventura, 2016).

College students are an interesting population to consider for dairy farm visits as they are developing consumer habits that may continue throughout their lives. These consumer habits will have a huge impact on our economy along with our food systems (Priporas, Stylos & Fotiadis, 2017). Today's college students predominately represent Generation Z, individuals born since the mid-1990's. Generation Z is poised to become the largest generation of consumers by 2020,

and it is estimated that they will spend approximately $44 billion annually (Fromm, 2018).

Statement of the Problem

If college students reflect the consumer concerns that research has identified from broader consumer studies, their levels of fluid milk consumption may continue to decline. College students' negative perceptions of dairy management may discourage consumption of milk and dairy products, as shown in dairy consumption levels in recent years (USDA Economic Research Service, 2018). Due to Generation Z's spending power, this population and their perceptions of the dairy industry were explored. Understanding the potential value of dairy farm visits as a consumer education tool is important for influencing consumers.

Purpose and Objectives

The purpose of this descriptive correlational study was to analyze college students' perceptions of the dairy industry before and after visiting an operating dairy farm to see if their perceptions changed, if at all. The objectives for the study are listed below:

1. Describe demographic characteristics and agricultural education background of farm visit participants.
2. Compare participants' perceptions of herd health prior to and after the farm visit.
3. Compare participants' perceptions of dairy regulations prior to and after the farm visit.
4. Compare participants' perceptions of farm practices prior to and after the farm visit.
5. Evaluate participants' satisfaction with the dairy farm visit.

Significance and Stakeholders

Due to the broad nature of this research, multiple parties benefit from this study about Generation Z perceptions in the context of a dairy farm visit. This study was needed to help the dairy industry better understand consumers' concerns and demands. This study may encourage consumers to understand dairy farming from the viewpoint of the famer, possibly obtain a glimpse into their typical day. This farm visit may also be beneficial for students in agriculture to understand consumer opinions. Agricultural educators may use the results of this study to improve on-farm education for consumers in the future.

Limitations and Assumptions

The limitations of the study were:

- The convenience sample approach was a limitation because results cannot be generalized to all college students as the participants were not randomly selected. Another limitation was the time of day and day of the week in which the study was carried out. Although more students may have wanted to participate, their schedules may have prevented them from doing so.
- Farmers' answers to participants' questions may have been influenced by the farmers' varied experiences and levels of expertise. This lack of standard, research-based answers presented a limitation.
- Participants and their dairy consumption levels prior to the farm visit were not measured as part of this study which presents a limitation. It is unknown if the participants were

actual dairy consumers, and if so, it is unknown if their consumption levels are consistent with typical consumers.

- One final limitation was the opinions college students already had before participating in the dairy farm visit as participants were recruited from a College of Agricultural Sciences and Natural Resources course. However, the course was open to students of all majors without regard to the students' academic major. Again, as a convenience sample approach, the results are limited to the participants studied.

In conducting this study, three assumptions were made:

- It was assumed that the consumers provided accurate answers to the survey questions and read the questions carefully.
- Research participants were asked not to post to social media or take any photographs during the farm visit. The consent form expressed this constraint as the dairy farm is a research facility that may have visible, proprietary research. It was assumed that this constraint influenced neither student satisfaction nor perception.
- The farm's physical condition (i.e., cleanliness) on the day the farm tour was conducted may have influenced the participants' perceptions. It was assumed that the farm's physical conditions were typical on the day the study was conducted.

Operational Definitions

The operational definitions for this study are listed below.

- Agritourism: is the union of agriculture and tourism, and it is designed to attract visitors to an agricultural enterprise (farm, ranch, or agricultural business) for education or entertainment and create additional income for the agricultural enterprise (National Agricultural Law Center, 2018).
- Dairy farm visit for consumers: a form of agritourism that involves hosting a group of consumers out to a dairy farm for an educational tour and opportunity to ask the dairy farmers questions (Ventura, 2016).
- College students: refers to any undergraduate or graduate student enrolled at the University of Tennessee (UT), Knoxville, for the spring semester in 2018.
- Farmers: refers to personnel of the UT Little River Animal and Environmental Unit, a research facility of the University of Tennessee, assigned to dairy production and management.
- Farm stations: various regions around the dairy farm where different topics were covered throughout the farm visit.
- Developmental evaluation: refers to the concept of developing new approaches in real-world situations. It is analogous to the concept of "research and development" in private sector product development. Evaluators use this approach when developing an innovation that addresses a complex problem or occurs in a complex environment (Better Evaluation, 2018).

CHAPTER TWO

LITERATURE REVIEW

The literature review presented here used the following databases and resources, available from the University of Tennessee Libraries:

- Agricola database
- Web of Science
- Academic Search Complete
- Agriculture Database (Web of Science)

Searches of these databases included the following search terms and phrases: "dairy production and consumer perception", "farm visits", "consumer perception of agriculture", "agricultural public education", "dairy farming", and "dairy perception". This chapter addresses the following: consumer concerns, agritourism, consumer demographics, generational differences, characteristics of Generation Z, and constructivism.

Consumer Concerns

According to Boogaard, the public's concerns with where their food comes from have been growing in recent years as people are becoming more and more removed from rural communities and farming altogether. [People want healthy, safe, cheap food available to them every day of the year but they are not pleased with new farming technologies that dairy farmers use to make that happen for them.] After being asked select questions by researchers, respondents were not sure how to feel, because economically, they want cheap food from their own country, but sometimes it saves money to have food imported. This study also recognized that those who grew up, have worked on, or lived near some sort of farm or rural community are more open to new technologies regarding agriculture (Boogaard, 2011).

In a study of 500 consumers, Croney (2011) found that consumers have specific concerns regarding the dairy industry. Specifically, consumers are worried about the sustainability and environmental impacts of modern farm practices, animal welfare and food safety. Croney postulated that addressing and understanding the frame of reference behind these ethical concerns is important to the long-term success of the dairy industry. The study concluded on the fact that as dairy industry practices continue to be ethically challenged, the need to further understand these consumer concerns becomes even greater (2011).

In another consumer study, participants completed a questionnaire regarding what factors influence their purchasing decisions when buying milk at the grocery store. Results indicated many consumers would be willing to spend more if they were insured a higher animal welfare quality. An interesting finding was the fact that consumers usually say slightly different answers when they are being interviewed verses when they are voting on specific policy changes for the government structure, like environmental regulations (de Graaf, 2016). Olynk (2013) studied consumers using a special technology to simulate an actual grocery store experience. The results showed a correlation between frequency of consumption and consumers' belief that dairy products "closer to the cow" are less processed so they worry about antibiotic use less as compared to other food items (Olynk, 2013).

Weinrich, Kuhl, Zuhlsdorf & Spiller (2014) studied consumer perceptions of dairy cow housing. They showed participants pictures of various dairy cow living arrangements and recorded their opinions regarding barn and pasture systems. The public associated a negative connotation to cows that live inside all year and a positive one to cows on pasture. Researchers noticed a correlation existed between those who had experience with farming and positive perceptions of dairy barn systems.

One study by Ventura (2015) chose to explore the differing knowledge and opinions regarding the dairy industry among professionals and consumers. Half of the study covered dairy industry professionals (including farmers and Extension agents) while the other half focused on consumers. Respondents were interviewed about their opinions on cow welfare and their views on problems. The study showed that there are welfare issues, like other agricultural industries, but it suggests that the best option for improving the public's opinions are on farm visits for consumers wanting to learn about the dairy industry (Ventura, 2015).

Agritourism

Agritourism is defined as the union of agriculture and tourism, and it is designed to attract visitors to an agricultural enterprise (farm, ranch, or agricultural business) for education or entertainment and create additional income for the agricultural enterprise. Agritourism allows farmers to market for their own farm and to facilitate a relationship with the public in their area. It also ensures the success of farms and the ability for them to earn their living and expand their businesses (National Agricultural Law Center, 2018).

In the United States, the first forms of agritourism can be dated back to the 1800s, when city dwelling families wanted to escape the heat in the summer so they chose to go visit farms out in the country. In the 1920's, when cars were available to the public, farm visits became even more possible to American families. During World War II and the Great Depression, families began to seek out an escape to the countryside even more. The public became increasingly interested in petting zoos, horseback riding and other forms of rural recreation in the 1960's and 1970's. Finally, in the 1980's and 1990's, farm bed and breakfasts, large farm tours and vacations out to rural farms became increasingly popular for consumers. Since Americans are sometimes four generations removed from farm life and that more people are disconnected from where their food comes from, agritourism provides an avenue for consumers to establish this important connection. Since 2000, there has been tremendous growth in the amount of agritourism programs available across the country ("A Brief History of Agritourism, Internationally and in the United States", 2013).

Internationally, farm visits and forms of agritourism called "farm stay holidays" were developed in Europe, Australia, and New Zealand. In Italy around the 1950's, many farms were abandoned when farmers decided to leave and find work in larger cities, to better provide for their families. An Italian law was passed in 1985 to offer incentives and rules on agritourism, to try and make it more popular in the country. Now Italy is home to almost 20,000 farms that participate in some level of agritourism. London developed WWOOF-ing (Working Weekends on Organic Farms) was developed in 1971 to provide a way for people to escape to the British countryside to get away from the large cities. Now WWOOF farms can be found in over 40 countries around the globe and are continuing to grow in popularity ("A Brief History of

Agritourism, Internationally and in the United States", 2013).

A potential drawback of agritourism could be landowner liability for the farmers or those in charge of the agritourism activities. Compliance with agritourism statutes can negate these legal risks. Agritourism is a growing industry since it can be an excellent way to educate the public about specific farming industries and create additional revenue for farmers (National Agricultural Law Center, 2018). A 2014 study sought to explore specifics behind agritourism and additional revenues earned for the farmers and their families. Results indicated that the profits were high for small farms where their focus was the farm. There was a positive revenue improvement for hobby farms, but not drastic ones. For larger farms, the profits improved, but not at a statistically significant level (Schilling, Attavanich & Jin, 2014).

A study based in the California Valley sought to explore sustainable community involvement and production agriculture. The study described potential future success of agritourism and if there were any aspects that could potentially make it more beneficial and profitable for farmers. Researchers explored the areas of farm sustainability and potential avenues in agritourism. The study concluded farmers should address both sustainable farming and community-involved forms of agritourism. This is because consumers will be more willing to support farms that are environmentally sustainable and those that offer various forms of agritourism to the community (Brodt, Feenstra, Kozloff, Klonsky & Tourte, 2006). A Michigan study used consumer focus groups to describe ways to strengthen agritourism for local farms and ensure the success of them. Respondents suggested that web pages personal referrals to other local agritourism farms were valuable for increasing visitation numbers. The research found that to combat competition between different agritourism areas, farmers must begin to work with each other to develop creative ideas to make all their farms a travel destination in the state (Che, Veeck & Veeck, 2005).

A 2012 study sought to explore the benefits and differences in agritourism and various other farm entrepreneurial ventures. Data from this study concluded that agritourism is highly successful in creating jobs, additional profits for the farm, and conserving cultural heritage along with the environment. Farmers exhibited a strong desire to continue the tradition of the farm and the agritourism aspect, as well as pass the business along to the next generation. This study confirmed that there are numerous benefits and very few pitfalls when it comes to adding a form of agritourism to a family farm (Barbieri, 2013).

Consumer Demographics

Researchers have explored consumers' demographic characteristics including income, gender, education levels, and their relationship with purchasing involvement. Consumers with the most purchasing power are usually women who have children, have high education levels and moderate income levels. This confirms that demographics of consumers are directly related to purchasing involvement and power, and it may be a useful explanation of consumer habits in future research (Slama & Tashchian, 1985).

Researchers have studied consumer demographics specifically relating to organic purchasing behaviors. A French study surveyed more than 54,000 adult consumers. Responses indicated that those who chose to purchase organic food products had more education, were less

overweight, and followed a diet of more recommended fiber and calorie levels as compared to those who did not choose organic products. The researchers also found that both male and female organic consumers had higher education levels than non-organic consumers. Regarding income levels, no significant differences were found between consumers who prefer organic and those who prefer conventional food. Other research in various countries has confirmed that consumer's income levels do not influence organic purchasing behaviors, but rather education level seemed to have the most impact (Kesse-Guyot et al., 2013).

A 2012 literature review explored factors that impact consumers buying behaviors, other than age, gender, education level and income. This analysis found two main characteristics impacting consumer buying habits. One of these avenues is overall health of the consumer, and how it predicts their buying behaviors. Multiple studies showed that consumer health, weight and daily exercise drastically influenced the types of decisions made by consumers. Those that were overweight chose fewer fruits and vegetables than those who were not overweight. The other characteristic that impacted consumer's purchasing habits was their personal opinions of environmental protection and sustainability of farms, making them more likely to purchase local foods marked as "sustainable". This literature review demonstrates the divergent factors associated with consumers and their motivations for purchasing specific food items (Verain et al., 2012).

Research has also examined consumers' willingness to sacrifice taste for health benefits available in certain foods. The findings showed that taste is the prevailing factor with the vast majority of consumers. In fact, only a small group of consumers select less appealing foods for the potential future health benefits (Verbeke, 2006).

Researchers have attempted to delineate the demographic information of consumers who had a more difficult time making purchasing decisions when buying food products. The results demonstrated that consumers that had the most difficult time choosing between brands, prices, and other factors in a grocery store were female, older in age, and were less educated. This and other studies of consumer demographics contribute to better understanding of consumers and may contribute to the success of agriculture (Walsh & Mitchell, 2005).

Characteristics of Prior Generations

The focus of this study are the consumer perceptions of college students towards the dairy industry. The evaluated (or subjects of program evaluation) for the study are dairy farm visits, a form of agritourism. Demographers and researchers commonly refer to today's college students as part of Generation Z, and previous generations are referred to as Millennials, Generation X, Baby Boomers, and Traditionalists. To understand Generation Z, the following discussion provides an overview of the previous generations. Specifically, information that defines the generations and describes what is known about their consumer perceptions and behaviors is delineated. This discussion is followed by a description of Generation Z which compares and contrasts Generation Z to previous generations with an emphasis on consumer perceptions and behaviors.

Millennials

Millennials are those individuals born from 1982-1994. This population is known for being excellent multi-taskers, technologically savvy, unafraid to seek advice, creative problem solvers, socially conscious, and highly selective when making buying decisions (Wmfc, 2018). It is known that this generation compares price when shopping, but these consumers are likely to pay more for a brand that they judge to be socially responsible ("Personality Traits of Millennials: How to Market this Generation; Morris Creative Group", 2018). Millennials would rather spend money on experiences than tangible goods. Millennial women have vast purchasing power as compared to previous generations ("15 Consumer Behaviors Setting 5 Generations Apart; Precision Dialogue", 2018).

Generation X

Generation X is composed of individuals born between 1965 and 1981. This generation values higher education, preserving the planet, independence, and work-life balance. This generation, can be suspicious of Baby Boomer values. Generation X think ethically, have a strong sense of entitlement, and are unimpressed and skeptical of authority (Wmfc, 2018). When making decisions, they have an expressed interest in having all the facts presented to them. They also have a high degree of brand loyalty. Generation X enjoys being loyal to specific brands and will take part in reward programs to try to save money. In fact, most will not purchase until they have read more about it. This generation wants to learn what to expect and why a specific product would benefit them ("15 Consumer Behaviors Setting 5 Generations Apart; Precision Dialogue", 2018).

Baby Boomers

The Baby Boomer generation was born between 1946 and 1964. Some characteristics include: optimism; a strong belief in equal opportunities; a tendency to question everything; a tendency to trust members of their generation rather than the younger generations; and a tendency to have good communication skills. From a consumer standpoint, this generation likes to be aware of the options available to them, and they appreciate choices and flexibility. They prefer direct, in person communication (Wmfc, 2018). Baby Boomers tend to be more individualistic as opposed to other generations that may be more influenced by peer decisions. Baby Boomers are believed to be more practical and pragmatic shoppers than other generations. It is believed that this generation has been saving substantial financial resources, and that they will have tremendous buying power through 2028 ("15 Consumer Behaviors Setting 5 Generations Apart; Precision Dialogue", 2018).

Traditionalists

Traditionalists were born prior to 1945 and are now making up a smaller portion of the consumer population. Today, they are 73 years of age or older. Due to their experience in wars in their lifetime and the Great Depression, they are thrifty and enjoy saving money. Traditionalists value hard work and loyalty in a major way. However, they do not conform to change or ambiguity well (Wmfc, 2018). This generation wants authenticity and transparency in their buying options as consumers. Traditionalists have more time available to spend with family and grandchildren, so they keep their loved ones in mind when shopping ("15 Consumer Behaviors Setting 5 Generations Apart; Precision Dialogue", 2018).

Characteristics of Generation Z

"Generation Z" encompasses those born from 1995 to 2012, and the majority of this generation are now on the cusp of adult life. Market analysts are defining them as "the next big retail disrupter" due to their anticipated amount of spending power. This generation is described as full of hard workers, slightly anxious, and mindful of the future and their impact on our world. Generation Z is also more ethnically diverse than the preceding generations and cultural issues are perceived differently by them, by having a more open-minded approach. Some researchers also note the highly protective upbringing of this generation, as many of their parents were overly cautious and focused on safety when raising their children. Overall, they tend to focus on sensible job and career options, enjoy leading private lives and tend to be cautious (Williams, 2018).

Members of Generation Z are comfortable with technology, as they have grown up using it- therefore they are constantly subjected to an informational overload (Williams, 2018). This generation to be made up of "digital natives", especially as compared to previous generations and it is anticipated that this will carry over into their consumer behaviors in the coming years (Hradiska, 2013). In a 2016 study, researchers discussed how Generation Z are a different category of learners inside and outside of the classroom. This generation is very technologically savvy and are self-motivated. Regular, lecture-type classes may not be as engaging and exciting for Gen Z, therefore new research like the present study, needs to be conducted to better understand this generation. Facilitating a dynamic, exciting learning environment, educators can begin to take the steps to encourage this generation in the learning process and be more engaged in an educational setting (Shatto & Erwin, 2016).

A recent study sought to better understand the technological marketing impacts and how they influence Generation Z and their purchasing decisions. The researcher noted that this generation is already behaving differently than past generations, since they are more focused on innovation. The study confirmed that technology has a strong impact on Generation Z consumers. It also solidified the fact that this generation majorly depends on technology to make informed consumer decisions. Therefore, Generation Z desires a more technology-based retail experience, to make their shopping experience simpler and more informed. This smart retailing approach is an important marketing tool since Generation Z is going to hold much of the buying power in the years to come (Priporas, Stylos & Fotiadis, 2017). Another 2017 study focused on marketing and how Generation Z are influenced by social media and their peer's decisions. Social media is the single most influential marketing tool for Generation Z (Silva, Machado & Cruz, 2017).

One study sought to explore the generational and gender differences regarding consumer buying habits and the wasteful nature of them. The survey design demonstrated that regardless of generation, women are better at keeping consumption levels reasonable and sustainable. However, results also showed that Generation Z excelled in reducing unneeded consumption of food and other consumer products, suggesting that they are more mindful consumers than previous generations (Bulut, Kökalan Çımrin & Doğan, 2017).

In summary, Generation Z has been shown to have several different consumer characteristics than previous generations, including their affinity for technology. This generation

will have substantial consumer buying power. Yet, very few studies show the consumer perceptions of Generation Z and how the agricultural industry might consider these perceptions for success.

Constructivism

Due to the complex nature of Generation Z students, there is much to consider when thinking of the most efficient ways to go about educating this specific generation. It is known that critical thinking and teamwork will be integral to their workplace success. One 2015 study focused on constructivism in the classroom. This study showed that cooperative learning (group work) greatly benefits on students and the development of their own ideas and conclusions. (Igel & Urquhart, 2012).

The definition of constructivism is when students in a learning environment are given deep understanding of a specific topic and their ideas cognitively develop to come up with their own constructions of learner reorganization. This is a highly complex and nonlinear learning process, vastly different than other learning styles. A major difference between constructivism and other learning styles is that it is not the result of development, learning is in fact, the development of the students' thoughts and ideas. Teachers need to allow learners time to develop their own questions and theories, to help them reach their own answers. These open-ended questions and learning techniques welcome student errors or mistakes because they are stepping stones in the constructivist journey. Students often learn well in a constructivist setting where they are interacting with their surroundings (Fosnot, 2005).

One study sought to understand graduate student cooperative learning and constructivism in a classroom setting and measured the students' opinions of it afterwards. Their general thoughts were that social interaction is necessary in the constructivist learning environment because it helps students to think through ideas logically and work out problems verbally. Cognitive development happens through understanding new topics and problem solving as a group. Lastly, the students determined that without social interaction, the constructivist learning would have been far less successful (Nyikos & Hashimoto, 1997).

In one study in 2006 at UC Davis, faculty and students developed a constructivist approach to a class curriculum for an agricultural class at the university. This learning style when tested proved to show great success due to the diverse nature of the material presented to the students. In various forms of learning environments, the student interest and retention levels clearly increased, showing that constructivist, outside-the-box thinking was highly successful in learning the new information (Parr & Van Horn, 2006).

In a study researching agricultural literacy and constructivist approach, researchers sought to explore ways to improve agricultural literacy throughout the general population of the United States. The model developed challenged the usual standardized testing approach, because more promising results were found in a constructivist, student communicative environment for learning. The researchers also proposed that as school systems grow and evolve, it is important for testing to do the same. Multiple teaching techniques are encouraged when teaching agricultural literacy in a classroom setting, due to the complex nature combined with lots of ideas open to interpretation by students. Working through the problems on their own along with

classmates helps students to better understand the content and empowers them to discuss it comfortably (Powell & Trexler, 2008).

Literature Review Summary

In the United States, less than two percent of the population is made up of farm and ranch families, and consumers are now up to three generations removed from farming- leading to a huge disconnect between the public and agriculture ("Our Food Link", 2018). Research has shown that consumers have varied concerns about dairy farming, including health (antibiotic use), farm management practices (housing) and regulations (on animal welfare and milk quality) (Croney, 2011). Additionally, consumers have voiced their concerns about food safety and the processing of dairy products (Olynk, 2013). In the last 30 years, agritourism has been growing in popularity, because consumers are interested in how their food is raised. The benefits for the farmers are noticeable too, such as additional income for the farm and creating a relationship with the public in their community (Barbieri, 2013). Consumers are now more health conscience than before and it has been shown that their personal health impacts the decisions they make when shopping at the grocery store (Verain et al., 2012). Broadly speaking, each generation brings a new set of demands as a population of consumers. This study chose to focus on Generation Z, because they are just now entering adulthood and this technology-driven group is going to be have a lot of buying power in the coming years (Williams, 2018). Generation Z is made up of a different kind of learners, they enjoy an engaging educational setting that is not a typical lecture-type classroom (Shatto & Erwin, 2016). A constructivist approach can be considered when thinking of Generation Z consumers, because it is said to be the most exciting and interesting one, where students can learn from their surroundings and arrive to their own conclusions (Fosnot, 2005).

CHAPTER THREE

MATERIALS AND METHODS

The materials and methods for this study are included in this chapter. It is organized into eight sections: purpose of the study, population, study design, variables, instrumentation, data collection, and data analysis of student participants' perceptions of the dairy industry. This study was approved by the University of Tennessee Institutional Review Board (see Appendix F).

Purpose of the Study

The purpose of this study was to analyze college students' perceptions of the dairy industry before and after visiting an operating dairy farm to see if their perceptions changed, if at all. The objectives for the study are listed below:

1. Describe demographic characteristics and agricultural education background of farm visit participants.
2. Compare participants' perceptions of herd health prior to and after the farm visit.
3. Compare participants' perceptions of dairy regulations prior to and after the farm visit.
4. Compare participants' perceptions of farm practices prior to and after the farm visit.
5. Evaluate participants' satisfaction with the dairy farm visit.

Study Design

The research design for this study was descriptive-correlational. A preexperimental design, the one-group protest-posttest design, was utilized (Campbell & Stanley, 1963). This research design is represented by:

O1___X___O2

Where: O1___=___consumer pretest (observation one)
X___=___dairy farm visit for consumers (treatment)
O2___=___consumer posttest (observation two)

Participants that chose to partake in this project completed the study instrument before and after participating in a dairy farm visit for consumers. This dairy farm visit included a tour, miniature lecture, and an opportunity to ask questions of dairy farmers. The study design represented a developmental evaluation approach whereby data was collected on how the program performs in complicated situations (Patton, 2006). In the study described here, tools were developed to facilitate and measure the results of a farm visit. Specifically, these tools were: pretest, posttest, farm visit talking points script, and farm visit mini-lecture. The pretest occurred before the farm visit and the posttest occurred after the farm visit. The other tools were used while the farm visit was in progress, not necessarily in lock-step, representing a developmental evaluation approach. In many ways, non-formal education, such as the farm visit conducted for this study, represents a complicated environment to study.

Population

The population for this study were college students aged 18 and older. A convenience sampling approach, which is a non-probability sampling method, was used for this study. Since the research was conducted at the University of Tennessee dairy farm, the research participants

were recruited from the University of Tennessee. Participants were recruited by partnering with the Food Science Department and the professor in charge of the History of Food course in Spring 2018. The researcher used two screening questions in recruiting research participants: the researcher asked potential participants if they were 18 years of age or older and if they could walk comfortably on level ground for approximately two hours. Research participants who answered the two screening questions in the affirmative were presented with an informed consent form. Only participants who signed the consent form could participate in this research study.

Participants were invited to be bussed to the UT dairy farm, complete a pretest, tour the farm, speak with farmers and employees for approximately 90 minutes and finish with a posttest and breakfast for the group. All participants signed a consent agreement prior to touring the farm.

Instrumentation

Questionnaire

The researcher developed a questionnaire to administer as a pretest (see Appendix B) and a posttest (see Appendix C). The questionnaire creation was informed by the literature review, to specifically address the research questions. Questions for this study were reviewed by a panel of three experts in both Animal Science (one expert) and Agricultural Leadership, Education, and Communications (two experts) to establish instrument validity. Minor phrasing and wording alterations were made to the pre/posttest versions prior to the pilot test in a classroom. Questions were also reviewed by management at the University of Tennessee Little River Animal and Environmental Unit.

The participants completed the two surveys; the pretest before the farm tour and the posttest after the farm tour. The only difference between the pretest and posttest is the fact that the pretest asked participants' demographic information and agriculture experience while the posttest inquired about dairy visit satisfaction. This pretest was designed to measure their initial thoughts of the dairy industry as well as collect their personal demographic information. Items focused on agreement or disagreement with dairy industry topics. This allowed for comparison measures to determine to what extent, if any, that participants' opinions changed from having the tour and getting to talk to the farmers about their concerns. The survey questions were modeled after Talbert's (1995, 1996 & 1997) survey question style about high schoolers' opinions about agriculture. A sample pretest and posttest question was: A cow's udder is cleaned prior to milking. A: Strongly Disagree. B: Disagree. C: Neutral. D: Agree. E: Strongly Agree. Questions were positively and negatively worded to reduce bias, for example the use of only positive questions may have produced only positive responses (Colton & Covert, 2007).

Pilot Test and Pilot Test Analyses

For the pilot test, a History of Food fall 2017 course was used and 47 participants completed the survey. During the pilot testing, participants did not express confusion with the phrasing of the questions, and the instrument delivered a high level of reliability.

Typically, for testing reliability with nominal data, a test/retest technique is used. However, for this study the budget and time involved prevented test/retest. Reliability for the

Likert-type scales was calculated using Cronbach's Alpha and can be found in Table 1. Reliability for different sections of the survey ranged from r=.881 to r=.884 with an overall reliability of r=.886 indicating high reliability per conventions by Davis (1971).

Table 1. Reliability Coefficients (N=47)

Section	Number of Items	Cronbach's Alpha: Pilot Test
Herd Health	8	.884
Dairy Regulations	8	.881
Farm Practices	9	.882
Overall	25	.886

Principal components analysis was used to identify and compute any potential factors. This analysis used pairwise deletion (statistical technique that deletes or removes one answer that is blank, rather than the whole case from the study) with varimax rotation (to simplify the expression in terms of just a few items). Ideally, there would have been one factor from each of the three main sections (Herd Health, Dairy Regulations, and Farm Practices) with a high level of variance. The initial Eigenvalues showed that the first factor explained 34% of the variance. Subsequent factors were more challenging to delineate than the initial factor. However, all items had a correlation of 0.4 or above with all other items. (See the correlation matrix for all 25 items in Table 8.) The pilot test sample of 47 did not meet the minimum suggested sample of 100 for principal components analysis (Gorsuch, 1993; Kline, 1979; MacCallum, Widaman, Zhang & Hong, 1999). As a developmental evaluation, the study reported here was not aimed at creating an instrument with measured scales. Therefore, the principal components analysis did not inform the questionnaire administration nor the data analyses, but the correlation data did indicate a quality instrument that was measuring similar constructs relative to dairy farms, reinforcing a high level of reliability.

After the pilot test, no items were eliminated from the instrument. However, one question was divided into three to simplify it. This question was originally stated as "Growing up, did you participate in 4-H, FFA or any school-related agriculture-related programs?". The item was separated into three questions on question numbers 6-9 on the pretest.

Farm Visit

To prepare for the farm visit, a talking points script (Appendix A) was provided to the farmers to ensure that all topics were covered when talking to the participants and to limit the likelihood of different farmers providing contradictory information. The participants had an hour-long guided tour of the dairy farm led by two of the farmers and an additional 30 minutes after the tour to ask any other questions to the employees and farmers.

Dairy Farming Presentation

The initial plan for the day of the dairy farm visit was for the participants to watch and listen to the PowerPoint presentation about the dairy industry in general, before beginning the walking portion of the farm tour. This presentation was also going to be presented and discussed by one of the farmers that oversaw helping to guide the walking tour of the farm. The day of the

actual dairy farm visit, the morning milking was almost complete when the participants arrived out to the farm, so the group began there, to give the participants the opportunity to see the milking parlor in action while cows were being milked. Since this was a major part of the pretest and posttest questions, it seemed very important for the participants to witness the milking parlor experience. Unfortunately, this meant that the presentation about the dairy industry had to be moved to the end of the schedule, after the walking tour portion was completed. For future farm visits and studies, it would be best to still allow for additional time to give the presentation by one of the farmers prior to the tour of the dairy farm. This would get some of the basic, initial questions out of the way and allow participants to begin brainstorming their own questions to ask on the tour. Another aspect that goes along with this is excellent communication and coordination with the dairy farm, ensuring that there will be enough time to do the presentation and still see some dairy cows in the parlor.

Data Collection

Initially to recruit participants, the researcher went to the History of Food Spring 2018 course to talk about the dairy farm visit and see which students had interest in touring the farm. Recruitment materials were distributed to students, which consisted of the Consent Form (Appendix D) and Cover Letter (Appendix E).

Transportation was provided to and from UT campus in Knoxville, Tennessee to the UT Little River Animal and Environmental Unit in Walland, Tennessee at no charge to the participants (approximately 40 miles round trip). On the day of the study, every participant signed two copies of the consent form, one that was kept and saved by the researcher and another for the participant to keep. Right after signing the consent forms the participants completed the pretest, prior to touring the dairy farm. The farm tour took place in one group of all eight participants at the same time and they moved from station to station as planned. To finish up the dairy farm tour, one of the farmers presented a mini-lecture using an on-screen presentation covering the broad ideas surrounding the dairy industry (Appendix G). After the dairy farm tour, the participants completed the posttest to measure to what extent if at all their perceptions of the dairy industry had changed. All the pretests and posttests were gathered and compiled in SPSS software for analysis.

Data Analysis

The survey data was inputted into IBM SPSS Statistics software for analysis (IBM Corp., 2017). Dependent variables in this study were to what extent consumer's opinions about the dairy industry changed after participating in the farm visit. The independent variables would be gender, race/ethnicity, current dairy consumption levels and buying behaviors. The topic areas were prior farm experience/knowledge, herd health, dairy regulations, farm practices, and farm visit satisfaction. The dependent variables were their attitudes towards the dairy industry.

Primarily, descriptive statistics were used, specifically, mean, mode, and percentage for the demographic questions. Data was analyzed using dependent t-tests to compare participants' perceptions from their pretest responses to their posttest responses. For the t-tests, a significance level of .05 was set a priori. For all t-tests, list wise deletion was used whereby a respondent who did not provide both a pretest and posttest response was excluded from the t-tests rather than from the entire study. In all cases, two-tailed tests were employed to test statistical significance

of possible increases or decreases in agreement level.

Sample Size

Unfortunately, this study yielded a low participant size for the actual farm visit study. The researcher was hoping to get approximately 30 participants to be able to participate, but only 8 could attend on the day of. Several factors may explain the reasoning behind this fact. First off, there was no true financial or other incentive that was possible to offer the participants, so undoubtedly, very few even showed a peaked interest in the dairy farm visit. The time of day of the study (7:30 AM- 10 AM) also may have been a factor in their decision-making process, as many undergraduates have morning classes. Since this study was seeking to test the instrument and how it handled a difficult environment, the conclusions found in this study can be carried over to future farm visit research and expanded upon with a larger sample size. It should be known that broad conclusions cannot be generalized to all college students at the University of Tennessee.

CHAPTER FOUR

RESULTS

The results for this study are presented in this chapter. It is organized into eight sections: purpose of the study, demographic characteristics of the farm visit participants, comparing participants' pre/posttest responses: herd health, comparing participants' pre/posttest responses: dairy regulations, comparing participants' pre/posttest responses: farm practices, evaluating participants' satisfaction levels with the farm visit, and a summary of key findings.

Purpose of the Study

The purpose of this study was to analyze college students' perceptions of the dairy industry before and after visiting an operating dairy farm to see if their perceptions changed, if at all. The objectives for the study are listed below:

1. Describe demographic characteristics and agricultural education background of farm visit participants.
2. Compare participants' perceptions of herd health prior to and after the farm visit.
3. Compare participants' perceptions of dairy regulations prior to and after the farm visit.
4. Compare participants' perceptions of farm practices prior to and after the farm visit.
5. Evaluate participants' satisfaction with the dairy farm visit.

Demographic Characteristics of Farm Visit Participants

Of the 8 participants in this study, 37.5% were 19 years old, 25% were 21 years old, 25% were 22 and 12.5% were 23 years or older. Much of the participants grew up in a residence that was not on a farm (87.5%) with only one participant having had a farm as a childhood residence (this does not count as childhood farm exposure or experience- only where they grew up). There were slightly more female participants (62.5%) than male participants in this study (Table 2).

Table 2. Demographic Profile of Participants

Characteristic	N	%
Childhood Residence		
Farm	1	12.5
Non-farm	7	87.5
Gender		
Male	3	37.5
Female	5	62.5
Prefer not to say	0	0.0
Age		
19	3	37.5
20	0	0.0
21	2	25
22	2	25
23 older	1	12.5

Agricultural Education Background of Participants

Of the participants in this study, 62.5% had previously been to a working dairy farm. The participants were equally represented regarding college majors. One-half of the group (50%) were in an agriculture-related program while the remainder were not in an agriculture-related major (50%). Three-fourths of the participants (75%) had not been involved in either 4-H or FFA earlier in life, while 62.5% had not been involved in any school-related agriculture-related program (Table 3).

Table 3: Dairy and Agricultural Exposure of Participants (N=8)

Experience	N	%
Been to a working dairy farm		
Yes	5	62.5
No	3	37.5
In an agriculture-related college program		
Yes	4	50.0
No	4	50.0
4-H involvement		
Yes	2	25.0
No	6	75.0
FFA involvement		
Yes	2	25.0
No	6	75.0
School-related agriculture-related program involvement		
Yes	3	37.5
No	5	62.5

Comparing Participants' Pre/Posttest Responses: Herd Health

Participants' herd health perceptions were measured using a 5-point scale where: 1= Strongly Disagree, 2= Disagree, 3= Neutral, 4= Agree, and 5= Strongly Agree. To test for differences, if any, among participants' regarding their perception of dairy herd health before and after the dairy farm tour, paired sample *t*-tests were performed. For the eight herd health items, five were found to be statistically significant as follows:

- For the item, *Dairy farms offer enrichment (such as cow scratchers) and other aspects to have a high level of animal welfare,* the results showed an increase in the student's agreement from pretest (M = 3.38, SD = .92) to posttest scores (M =4.5, SD = .53, t = -3.81, $p \leq .05$).
- For the item, *Dairy farmers ask for help from nutritionists to make sure the cows are eating quality diets,* the results showed an increase in the students' agreement from posttest scores (M = 4.63, SD = .52) as compared to the pretest (M = 3.88, SD = .991, t= -2.393, $p \leq .05$).
- The item, *Dairy cows are always pregnant and never given a break from milking,* has reverse polarity, whereby a decreased posttest mean indicates increased positive perceptions of the dairy industry. From the pretest (M = 2.38, SD = .92) to the posttest (M = 1.63, SD = .52, t = 2.049, $p \leq .01$), respondents' agreement decreased.
- For the item, *Dairy cows are only given antibiotics when they are ill and in need of them,* the responses from the pretest (M = 3.0, SD = .93) to posttest (M = 4.38, SD = .52, t = -4.245, $p \leq .05$) indicating that respondents' perceptions changed from neutral to agreement.
- Finally, the item, *Dairy cows are uncomfortable because they stand for most their days,* showed statistically significant differences from pretest to posttest. This item has reverse polarity, meaning that a disagreement answer is the positive response. From the pretest (M = 2.38, SD = .92) to the posttest (M = 1.5, SD = .53, t = 2.497, $p \leq .05$), indicating that agreement decreased.

When comparing pretest and posttest means for the other herd health items, none were found to have statistically significant differences as shown in Table 4. The mean score for hoof trimming decreased from pretest (4.13) to posttest (3.75) indicating some neutrality regarding perceptions. The mean score for overall health only slightly increased from pretest (1.25) to posttest (1.63) for this negatively worded item suggesting (a) that participants perceive that dairy farmers do care about the overall health of their cows, and (b) the dairy farm visit had no effect on this perception. Regarding the negatively worded item, cows constantly being genetically altered, the pretest (2.38) and the posttest (2.38) means were identical. This indicates that (a) participants perceive that dairy cows are not constantly being genetically altered, and (b) the dairy farm visit did not change their perception of this.

Table 4. Herd Health (N=8)

Variable	Mean	SD	*t*	*p*
1. Dairy farmers schedule annual hoof trimmings to help prevent cows from becoming lame and being in pain.	-.38	.74	1.426	.197
Pretest	4.13	.35		
Posttest	3.75	.89		
2. Dairy farmers do not care about the overall health of their cows.°	-.38	1.51	-.704	.504
Pretest	1.25	.46		
Posttest	1.63	1.41		
3. Dairy cows are constantly being genetically altered.°	0	1.07	.000	1.00
Pretest	2.38	.52		
Posttest	2.38	.92		
4. Dairy farms offer enrichment (such as cow scratchers) and other aspects to have a high level of animal welfare.	-1.13	.84	-3.813	.007*
Pretest	3.38	.92		
Posttest	4.5	.54		
5. Dairy farmers ask for help from nutritionists to make sure the cows are eating quality diets.	-.75	.89	-2.393	.048*
Pretest	3.88	.99		
Posttest	4.63	.52		
6. Dairy cows are always pregnant and never given a break from milking.°	.75	1.04	2.049	.080**
Pretest	2.38	.92		
Posttest	1.63	.52		
7. Dairy cows are only given antibiotics when they are ill and in need of them.	-1.38	.92	-4.245	.004*
Pretest	3.0	.93		
Posttest	4.38	.52		
8. Dairy cows are uncomfortable because they stand for most their days. °	.88	.99	2.497	.041*
Pretest	2.38	.92		
Posttest	1.5	.54		

* $p \leq .05$; ** $p \leq .01$; *** $p \leq .001$

[a] Respondents used the following scale to answer these questions: 1= Strongly Disagree, 2=Disagree, 3=Neutral, 4=Agree, 5=Strongly Agree

° Items marked with this have reverse polarity, whereby disagreement is the positive response

Comparing Participants' Pre/Post Responses: Dairy Regulations

Participants provided their perceptions on dairy regulations in respect to the dairy farm visit and a 5-point scale was used to do so. The scale is 1= Strongly Disagree, 2= Disagree, 3= Neutral, 4= Agree, and 5= Strongly Agree. To test for differences, if any, among participants' regarding their perception of dairy regulations prior to and after the dairy farm tour, paired sample *t*-tests were performed. For the eight dairy regulation items, five were found to be statistically significant.

- For the item, *Animal inspectors visit dairy farms on a regular basis to make sure no animals are being abused,* the results showed an increase in the student's agreement from pretest (M = 3.63, SD = 1.41) to posttest scores (M = 4.25, SD = .71, t = -.284, $p \leq .01$).
- On another item, *If antibiotics are found in a farm's milk, the whole tank will be thrown out and not sold to a processing plant,* responses demonstrated an increase from pretest (M = 3.5, SD = .54) to the posttest responses (M = 4.5, SD = .54, t = -3.055, $p \leq .05$).
- For the item, *New research is constantly looking for ways to improve milk quality,* the numbers showed a slight increase from the pretest (M= 4.0, SD= .76) to the posttest (M = 4.75, SD = .46, t = -3.0, $p \leq .05$) in participants' responses.
- With the item, *Farmers conserve the environment and want to have the smallest negative impact possible,* the participants' responses from the pretest (M = 3.88, SD = .64) to the posttest (M = 4.75, SD = .46, t = -3.862, $p \leq .05$) increased.
- Lastly, on the item, Incentive monetary programs are offered to dairy farms with lower Somatic Cell Counts (white blood cells in milk) suggesting that their cows are generally, healthier, participants' responses from the pretest (M = 3.38, SD = .52) to the posttest (M = 4.13, SD = .64, t = -3.0, $p \leq .05$) increased.

Results for all tests of the dairy regulations items are shown in Table 5. The mean score for employee protocols increased from pretest (1.63) to posttest (1.75), indicating some disagreement regarding participants' perceptions. The mean score for strict regulations on dairy products there was no change in the data from the pretest (4.5) to posttest (4.5) for this item suggesting (a) that participants perceive that dairy products are highly regulated, and (b) the dairy farm visit had no effect on this specific perception. Regarding the negatively worded item, there are no regulations on manure management for dairy farms, the pretest (2.0) and the posttest (1.88) means changed, suggesting a stronger level of disagreement than before. This indicates that participants appear to feel confident in the regulations that are in place for dairy farms.

Table 5: Dairy Regulations (N=8)[a]

Variable	Mean	SD	*t*	*p*
1. Animal inspectors visit dairy farms on a regular basis to make sure no animals are being abused.	-.63	.92	-1.93	.095**
Pretest	3.63	1.41		
Posttest	4.25	.71		
2. Dairy farm employees do not have protocols to follow or training before they begin working on the farm. °	-.125	1.25	-.284	.785
Pretest	1.63	.52		
Posttest	1.75	1.39		
3. Dairy products are highly regulated agricultural products.	0.0	.54	0.0	1.0
Pretest	4.5	.54		
Posttest	4.5	.54		
4. If antibiotics are found in a farm's milk, the whole tank will be thrown out and not sold to a processing plant.	-1.00	.93	-3.055	.018*
Pretest	3.5	.54		
Posttest	4.5	.54		
5. New research is constantly looking for ways to improve milk quality.	-.75	.71	-3.00	.020*
Pretest	4.0	.76		
Posttest	4.75	.46		
6. Farmers conserve the environment and want to have the smallest negative impact possible.	-.88	.64	-3.862	.006*
Pretest	3.88	.641		
Posttest	4.75	.463		
7. There are no regulations on manure management for dairy farms. °	.13	.641	.552	.598
Pretest	2.0	.53		
Posttest	1.88	.64		
8. Incentive monetary programs are offered to farms with lower Somatic Cell Counts (white blood cells in milk) suggesting that their cows are generally, healthier.	-.75	.71	-3.00	.020*
Pretest	3.38	.52		
Posttest	4.13	.64		

* $p \leq .05$; ** $p \leq .01$; *** $p \leq .001$

[a] Respondents used the following scale to answer these questions: 1= Strongly Disagree, 2=Disagree, 3=Neutral, 4=Agree, 5=Strongly Agree

° Items marked with this have reverse polarity, whereby disagreement is the positive response

Comparing Participants' Pre/Post Responses: Farm Practices

Participants' perceptions were measured on farm practices using a 5-point scale where 1= Strongly Disagree, 2= Disagree, 3= Neutral, 4= Agree, and 5= Strongly Agree. Out of the nine questions in part three, seven were statistically significant.

- For the item, *Only female dairy calves are useful on the farm*, the item had reverse polarity whereby disagreement was the positive response. From the pretest (M = 2.63, S.D. = .71) to the posttest (M = 4.38, S.D. = .52, t = -7.0, $p < .00$) the participants strengthened their agreement that male and female dairy calves do not have the same value on the farm.
- For the item, *Dairy calves are removed from their mothers, thus receiving poor nutrition,* the question had reverse polarity, meaning that disagreement was the positive response. From the pretest (M = 2.13, SD = .35) to the posttest (M = 1.5, SD = .54, t = 2.38, $p \leq .05$) the participants gave stronger disagreement responses.
- On the item, *Dairy barns are cleaned at least once a day while the bedding is cleaned 2 to 3 times each day,* there was increased agreement from the pretest (M = 3.75, SD = .46) to the posttest (M = 4.5, SD = .54, t = -4.583, $p \leq .05$).
- On the item, *Dairy farmers want to keep things as clean as possible to limit the spread of disease and provide high quality milk,* the participants indicated higher agreement level from pretest (M = 4.5, SD = .54) to posttest (M = 4.88, SD = .36, t = -2.049, $p \leq .01$).
- For the item, *Because milking parlors are dirty, bacteria will get into the milk,* the question had reverse polarity, meaning that a disagreement response is the positive response. Agreement decreased from pretest (M = 2.88, SD = .84) to posttest (M = 2.0, SD = 1.07, t = 3.862, $p \leq .05$).
- On the item, *Milking employees follow sanitizing protocols like: wearing new gloves for each shift and disinfecting the cow's udders,* there was an increase in responses from pretest (M = 4.38, SD = .52) to posttest (M = 4.88, SD = .36, t = -2.646, $p \leq .05$).
- Lastly, on the item, *Newborn dairy calves are fed colostrum to help jump start their immune systems,* agreement increased (M = 3.88, SD = .84) to posttest (M = 4.5, SD = .54, t = -2.38, $p \leq .05$).

The other three questions in this section were not found to be statistically significant and are listed in Table 6. The mean score for raw milk vs. pasteurized milk was identical from the pretest (2.63) to posttest (2.63), which suggests that (a) participants disagree about this idea of milk and (b) the dairy farm visit had no effect on this specific perception. Regarding the negatively worded item, dairy cows live in their own waste on a constant basis, the pretest (2.13) and the posttest (2.38) means were slightly increased. This indicates that (a) participants perceive that dairy cows are not living in their own waste constantly and (b) the dairy farm visit did in fact change their perception of these topics.

Table 6: Farm Practices (N=8)[a]

Variable	Mean	SD	*t*	*p*
1. Raw milk is healthier than pasteurized milk. °	2.63	.93	.00	1.0
Pretest	2.63	1.06		
Posttest	2.63	1.19		
2. Only female dairy calves are useful on the farm. °	-1.75	.71	-7.0	.000***
Pretest	2.63	.74		
Posttest	4.38	.52		
3. Dairy calves are removed from their mothers, thus receiving poor nutrition. °	.63	.74	2.38	.049*
Pretest	2.13	.35		
Posttest	1.5	.54		
4. Dairy barns are cleaned at least once a day while the bedding is cleaned 2 to 3 times each day.	-.75	.46	-4.583	.003**
Pretest	3.75	.46		
Posttest	4.5	.54		
5. Dairy farmers want to keep things as clean as possible to limit the spread of disease and provide high quality milk.	-.38	.52	-2.049	.080*
Pretest	4.5	.54		
Posttest	4.9	.35		
6. Because milking parlors are dirty, bacteria will get into the milk. °	.88	.64	3.862	.006**
Pretest	2.88	.84		
Posttest	2.0	1.07		
7. Milking employees follow sanitizing protocols like: wearing new gloves for each shift and disinfecting the cow's udders.	-.50	.54	-2.646	.033*
Pretest	4.38	.52		
Posttest	4.88	.36		
8. Dairy cattle live in their own waste on a constant basis. °	-.25	1.04	-.683	.516
Pretest	2.13	.61		
Posttest	2.38	1.19		
9. Newborn dairy calves are fed colostrum to help jump start their immune systems.	-.63	.74	-2.376	.049*
Pretest	3.88	.84		
Posttest	4.5	.54		

* $p \leq .05$; ** $p \leq .01$; *** $p \leq .001$

[a] Respondents used the following scale to answer these questions: 1= Strongly Disagree, 2=Disagree, 3=Neutral, 4=Agree, 5=Strongly Agree

° Items marked with this have reverse polarity, whereby disagreement is the positive response.

Participants' Satisfaction with the Dairy Visit

Participants provided their overall satisfaction with the dairy farm visit at the end of the study and they used a 5-point scale to explain their thoughts. The scale is 1= Strongly Disagree, 2= Disagree, 3= Neutral, 4= Agree, and 5= Strongly Agree. 87.5% of the participants marked "Strongly Agree" or "Agree" when asked if the dairy visit taught them something they did not know before. Once again, 87.5% of the participants selected "Strongly Agree" or "Agree" when asked if the dairy visit motivated them to buy more dairy products. When the participants were asked if they would recommend this dairy visit to others, 100% chose "Agree" or "Strongly Agree". Also, 100% of the participants agreed or strongly agreed that all their questions about the dairy industry were answered on the visit. Finally, 87.5% marked "Strongly Agree" or "Agree" when asked if their perspective of the dairy industry is more positive because of this visit (Table 7).

Table 7: Dairy Visit Satisfaction (N=8) [a]

Variable	Mean	SD	N	%
This dairy visit taught me something I did not know before.	4.38	.74	(8)	(100)
Neutral			1	12.5
Agree			3	37.5
Strongly Agree			4	50
This visit has motivated me to buy more dairy products.	4.0	.93	(8)	(100)
Strongly Disagree			1	12.5
Agree			5	62.5
Strongly Agree			2	25
I would recommend this dairy visit to others.	4.75	.46	(8)	(100)
Agree			2	25
Strongly Agree			6	75
My questions about the dairy industry were answered today.	4.38	.52	(8)	(100)
Agree			5	62.5
Strongly Agree			3	37.5
My perspective on the dairy industry is more positive because of this visit.	4.25	.71	(8)	(100)
Neutral			1	12.5
Agree			4	50
Strongly Agree			3	37.5

[a] Respondents used the following scale to answer these questions: 1= Strongly Disagree, 2=Disagree, 3=Neutral, 4=Agree, 5=Strongly Agree

Summary of Key Findings

The following is a summary of the key findings of this study, organized by each of the objectives.

Participant Demographics & Agricultural Education Background

The demographic information collected from the 8 participants in this study were age, childhood residence, and gender. 37.5% of the participants were 19 years old, 25% were 21 years of age, 25% were 22 years old, and 12.5% were 23 years or older. Most of the participants, 87.5%, grew up in a childhood residence that was not on a farm, with only one participant grew up on a farm. Finally, there were slightly more female participants (62.5%) than male participants in this study.

The personal agricultural educational background information that was collected in this study focused on dairy farm exposure, college majors, FFA, 4-H, and school-related agricultural-related programs in the pasts of the participants. 62.5% had previously been to a working dairy farm prior to this dairy visit study. The participants were equally represented regarding their college majors. One-half of the group were in an agriculture-related college program, while the remainder were not in an agriculture-related major. Three-fourths of the participants had not been involved in either 4-H or FFA earlier in life, while 62.5% had not been involved in any school-related agriculture-related program previously in life.

Participant Herd Health Responses

Participants changed their perceptions of herd health because of the dairy farm visit. Specifically, statistically significant increases were found in participants' level of agreement in the use of enrichment (cow scratchers); a dairy nutritionist aiding in dietary formulation; pregnancy care; proper antibiotic usage and withdrawal periods; and cow comfort. However, participants' perceptions of hoof trimming, overall health, and genetically altered cows did not change due to the farm visit.

Participant Dairy Regulation Responses

Participants in this farm visit study altered their perceptions regarding dairy regulations because of the dairy farm visit. Specifically, statistically significant increases were found in the participants' levels of agreement to the following topics: animal welfare inspectors; antibiotic testing before milk is processed (whole tank is thrown out if test is failed); milk quality research (constantly learning on how to improve SCC levels); environmental rules (farmers wanting to conserve resources); and incentive monetary programs available for dairy farms (earn extra money if SCC is lower). However, participants' perceptions of dairy employee training/protocols, regulations on dairy products and manure management rules did not change because of the farm visit.

Participant Farm Practice Responses

Participants changed their perceptions of farm practices because of the dairy farm visit. Specifically, statistically significant increases were found in participants' levels of agreement regarding the topics of: calf removal from mother cows; female calves being more valuable than

male calves; barn/bedding cleanings (daily/2-3 times each day); how farmers try to limit the spread of disease on the farm and produce high quality milk; cleanliness of milking parlors; milking parlor procedures for employees to follow (new gloves every milking/ udder disinfectant) and the importance behind them; and colostrum feedings to newborn calves. Conversely, participants' perceptions of raw milk nutritional information and dairy cows live in their own waste on a constant basis did not change due to the farm visit.

Satisfaction with Dairy Farm Visit

The final objective of the study was to measure participants' satisfaction levels regarding the dairy farm visit. 87.5% of the participants either agreed or strongly agreed when asked if the dairy visit taught them something they did not know prior to the visit. Once again, 87.5% of the participants selected responded positively with "Strongly Agree" or "Agree" when they were asked if the dairy visit motivated them to buy more dairy products in the future. When the participants were asked if they would recommend this dairy visit to others, 100% agreed or strongly agreed positively. Also, 100% of the participants agreed or strongly agreed that all their questions about the dairy industry were answered on the visit at the dairy. Lastly, 87.5% responded positively and agreed or strongly agreed when they were asked if their perspective of the dairy industry is more positive because of this visit.

CHAPTER FIVE

CONCLUSIONS, DISCUSSION AND RECOMMENDATIONS

This study's conclusions, discussion, and recommendations are included in this chapter. It is organized into four parts: purpose of the study, discussion and implications, conclusions, and recommendations for future research.

Purpose of the Study

The purpose of this study was to analyze college students' perceptions of the dairy industry before and after visiting an operating dairy farm to see if their perceptions changed, if at all. The objectives for the study are listed below:

1. Describe demographic characteristics and agricultural education background of farm visit participants.
2. Compare participants' perceptions of herd health prior to and after the farm visit.
3. Compare participants' perceptions of dairy regulations prior to and after the farm visit.
4. Compare participants' perceptions of farm practices prior to and after the farm visit.
5. Evaluate participants' satisfaction with the dairy farm visit.

Discussion and Implications

This study offers evidence for the use of dairy farm visits as a consumer education tool, particularly for Generation Z consumers. The results of small studies such as this one present important considerations for dairy producers, agricultural educators, and researchers for the future. This study presents valuable information for planning and conducting larger participant studies of consumer perceptions and dairy farm visits in years to come. The following discussion suggests implications regarding dairy farm visits for consumers and consumer perceptions, including ways to improve the dairy farm visit experience.

Dairy Farm Visits for Consumers

Overall, participants held positive perceptions regarding certain aspects of the dairy industry prior to the farm visit. For example, participants perceived that dairy farmers care about the overall health of their cows, and the dairy farm visit had no influence on this perception as measured via pretest and posttest. This is not surprising given that over 60% of the participants had been to a working dairy farm before. This suggests that dairy farm exposure alone can lead to a more positive perception of the industry. However, it is interesting to note that despite the participants' agricultural background, they developed even more favorable perceptions of herd health, dairy regulations, and farm practices after touring the dairy farm.

Dairy farm visits are a valuable educational tool because they change consumer perceptions of the dairy industry. As Ventura discussed in his 2016 study, overall perceptions improved after providing a guided dairy farm visit, but some consumer concerns remained the same, even after the tour. College student participants in this study make up an interesting portion of the consumer population. This generation, also known as Generation Z, is in the process of developing their buying behaviors and will eventually make up a significant portion of

consumers in the United States with a great deal of buying power (Priporas, Stylos & Fotiadis, 2017).

Since a dairy farm is a dynamic environment, this study took a developmental approach (Patton, 2006). This refers to the concept of developing new evaluative approaches in real-world situations. It is analogous to the concept of "research and development" in private sector product development. Evaluators use this approach when developing an innovation that addresses a complex problem or one that occurs in a complex environment. In the study described here, tools were developed to facilitate and measure the results of a farm visit. Specifically, these tools were: pretest, posttest, farm visit talking points script, and farm visit mini-lecture. The pretest occurred before the farm visit and the posttest occurred after the farm visit. The other tools were used while the farm visit was in progress, representing a developmental evaluation approach (Better Evaluation, 2018). This developmental approach is essential to explore how farm visits could be improved in the future, because of their complex nature that include multiple variables and factors.

Consumer Perceptions

This study sought to identify concerns regarding dairy farming, if any, among Generation Z consumers and determine the value of a dairy farm visit. Positive changes in consumer perception were found across all areas in this study: herd health, dairy regulations, and farm practices. This suggests that the dairy farm visit aided in the participant's understanding of many specific topics regarding the dairy industry. However, a closer examination of the topics showed areas where the participants' perceptions were not altered. Specifically, participants disagreed that "raw milk is healthier than pasteurized milk" and "dairy cattle live in their own waste on a constant basis". Interestingly, the study did not alter the participants' perceptions from "disagree" to "strongly disagree" for these two items. Therefore, both pasteurized milk and waste management may be areas of emphasis for future investigation and education.

One reason that could explain perceptions to these two topics that the farmers who led the farm tour did not directly reference the topics or make the point clear to the participants. A second idea is that potentially the participants misunderstood the details surrounding that topic. To ensure that consumers develop their understanding, it is essential that the educators provide an intentional educational experience. In other words, educators conducting dairy farm visits must be clear, concise, and discuss all the important consumer topics. Croney (2011) postulated that consumer concerns were loosely based around food safety, animal welfare, modern farm practices and the environmental impacts of farming. As Boogaard (2011), mentioned in his works, consumers are demanding healthy, safe and cheap food available to them, but they may be deterred by some of the newer farming practices. This study underscores that while consumers do have expansive topics and concerns, pasteurized milk and waste management may be areas for educational emphasis with Generation Z consumers.

A dairy farm visit does not address every educational need. After the farm visit, more participants tended to agree that: (a) dairy farmers do not schedule annual hoof trimmings to help prevent cows from becoming lame and being in pain, (b) only female dairy cows are useful on the farm, and (c) dairy cattle live in their own waste on a constant basis. Potentially, participants witnessed or heard something during the dairy farm visit that swayed their opinions. Participants

may have remembered a certain idea they heard or read prior to the farm visit which led them to respond negatively. This is consistent with Ventura's (2016) self-led farm visit study that surveyed consumers before and after touring a dairy farm. The results of that study suggested that consumers still had concerns surrounding specific topics, even after the dairy farm visit (Ventura, 2016). To address these concerns from consumers, more research needs to be conducted in this specific area with a larger sample size.

Dairy Visit Satisfaction Levels

Participants reported high satisfaction with the dairy farm visit. Almost 90% of the participants selected "Agree" or "Strongly Agree" when asked: (a) if this dairy visit had motivated them to buy more dairy products in the future, (b) if they were taught something new on the dairy visit, and (c) if their perception of the dairy industry is more positive because of the farm visit. All the participants also reported agreement when asked if all their questions were answered on the dairy farm visit. Lastly, all the participants in the study indicated a high level of agreement in the posttest satisfaction section and said they would recommend this dairy visit to others. Overall, these responses from the participants suggest that the dairy visit was a success in teaching Generation Z consumers something new about the dairy industry and most importantly, they left the visit with a more positive perception of the industry. Farm visits as an educational tool are consistent with the literature about Generation Z learning preferences. As Shatto & Erwin (2016) discussed, this population of students enjoy a more exciting, dynamic learning environment. The positive responses recorded from this group of Generation Z students reinforces the need to provide education in new environments, including outdoors.

Since 62.5% of the participants in this study had previously been to a working dairy farm, this previous experience may have influenced those who chose to participate. If their previous experiences were positive, informative and interesting ones, they may have been motivated to participate in this study. It is also important to take perceptions into consideration when looking at the conclusions from the study, because any preconceived perceptions could have been due to their past experiences on dairy farms. Measuring consumer satisfaction as part of dairy farm visits provides a great opportunity for participants to voice their ideas for improving the farm visit and any potential complaints. These types of discussions will only aid in improving dairy farm visits and ensuring their success and importance in the future.

Dairy Farm Visit Improvements

A major limitation of this study was the date and time that the dairy farm visit occurred. Since 8 AM classes are common for undergraduate students, it would have been beneficial to have the dairy farm tour in the late afternoon or evening to better accommodate the college student's class schedules. In the future, it would be interesting to see how many undergraduate college students would be able to attend an afternoon/evening dairy farm visit in which they got to observe the evening milking, rather than the morning milking. With more participants from diverse backgrounds, the results would be more meaningful and more representative of Generation Z consumers.

For future farm visits, scheduling should coincide with the schedules of the potential participants and take into consideration the target population for the study. Planning a time in which the dairy farm visit accommodates many more of the potential participants' schedules is

vital to the success of this form of agricultural education, especially when studying Generation Z. With a more expansive and diverse group of participants, dairy farmers will be able to reach more consumers within the population, making a broader impact. Ensuring that participant work and school schedules do not overlap with the dairy farm visit is an excellent idea and will only make it simpler and more possible for the participants to choose to participate if that is their desire.

Another limitation for this study was the weather on the day of the dairy farm visit. Since it was conducted in January, potential participants may have been deterred by the colder temperatures and chosen not to participate. Ideally, conducting the study in the warmer months of the year would be ideal. Warmer weather could also positively affect participant numbers, therefore leading to stronger participant numbers as well as responses for the study.

The researcher developed a talking points script for the farmers to use while discussing dairy topics during the farm visit. The goal of this was to encompass the topics that address consumer concerns about herd health, regulations, and farm practices (and were addressed on the pretest and posttest). This was done to give participants a frame of reference regarding common dairy cattle and farm management practices.

The farmers providing the dairy farm visit did not follow the talking points script in all cases during the farm visit, specifically in these areas: (a) the differences between raw milk and pasteurized milk; (b) bull calves and their usefulness on a dairy farm; and (c) hoof trimmings for the herd along with the importance behind them. When comparing pretest and posttest results, these were the same topic areas where participants did not demonstrate a change in perception.

Therefore, this reaffirmed the researchers' use of the talking points script. For future farm visits and research, it would be beneficial to confirm with the farm educators the importance behind discussing each one of the topics and potentially assign certain topics to certain people to assure the accurate communication of information.

Conclusions

The study conclusions are organized by research objectives.

Research Question 1: Describe demographic characteristics and agricultural education background of farm visit participants.

Conclusion: The majority of participants were: female, did not grow up on a farm, had previously been to a working dairy farm, and lacked previous experience in 4-H, FFA and school-related agricultural-related programs. Participants were evenly split between having an agricultural college major and having a non-agricultural major.

Support: Of the participants in this study, 62.5% were female, 87.5% did not grow up on a farm, and 62.5% had previously been to a working dairy farm prior to this study. Also, 25% of the participants had been involved in 4-H and FFA while 37.5% had been involved in a school-related agriculture-related program. One-half of participants were majoring in an agricultural discipline, and one-half were not majoring in agriculture.

Research Question 2: Compare participants' perceptions of herd health prior to and after the farm visit.

Conclusion: Participants' perceptions of dairy farm herd health improved because of the farm visit experience.

Support: Statistically significant increases were found in participants' level of agreement in the use of enrichment (cow scratchers), dietary quality (using a nutritionist), pregnancy care, antibiotic usage, and cow comfort.

Conclusion: Participants in this farm visit study showed high levels of agreement with the following perceptions before the farm visit: (a) dairy farmers schedule annual hoof trimming to prevent lameness and pain, (b) dairy farmers care about the overall herd health, and (c) dairy cows are not being constantly genetically altered; and none of the perceptions changed substantially due to the farm visit.

Support: The mean score decreased from pre-test to post-test for the hoof trimming item. The mean score increased for perception of overall health, but not at a statistically significant level. The mean score remained the same from pre-test to post-test for perceptions of genetically altered cows.

Research Question 3: Compare participants' perceptions of dairy regulations prior to and after the farm visit.

Conclusion: Participants in this farm visit study developed more favorable perceptions of dairy regulations (related to consumer milk quality and environmental concerns) because of the dairy farm visit.

Support: The statistically significant increases were found in the participants' levels of agreement to the following topics: animal welfare inspectors, antibiotic testing before milk is processed (whole tank is thrown out if test is failed), milk quality research (constantly learning on how to improve SCC levels), environmental rules (farmers wanting to conserve resources), and incentive monetary programs available for dairy farms (earn extra money if SCC is lower). 62.5% of the items in this section regarding dairy regulations were statistically significant to suggest that participants' levels of agreement increased from the pretest to the posttest.

Conclusion: Participants in this farm visit study showed agreement with the following perceptions before the farm visit: (a) dairy products are highly regulated agricultural products, (b) dairy farm employees have protocols to follow or training, and (c) dairy farms have regulations on manure management; and none of these perceptions changed substantially due to the farm visit.

Support: The mean scores for dairy products as highly regulated agricultural products and dairy farm employees following protocols or training showed slight increases in agreement, but not at statistically significant levels. The mean scores remained the same from pretest to posttest for perceptions of genetically altered cows.

Research Question 4: Compare participants' perceptions of farm practices prior to and after the farm visit.

Conclusion: Participants perceptions of farm practices improved because of the dairy farm visit.

Support: Statistically significant increases were found in participants' levels of agreement regarding calf removal from mother cows; female calves being more valuable than male calves; barn/bedding cleanings (daily/2-3 times each day); how farmers try to limit the spread of disease on the farm and produce high quality milk; cleanliness of milking parlors, milking parlor procedures for employees to follow (new gloves every milking/ udder disinfectant) and the importance behind them; and colostrum feedings to newborn calves. 66.7% of the items in this category regarding dairy farm practices were statistically significant to suggest that participants' levels of agreement increased from the pretest to the posttest.

Conclusion: Participants in this farm visits study tended to agree with the following perceptions before the farm visit: (a) raw milk and pasteurized milk have the same overall health value, (b), waste management practices ensure that cattle do not "live in their own waste". Neither of these perceptions changed due to the farm visit.

Support: The mean scores showed more agreement from pretest to posttest for the waste management item, but not at a statistically significant level. The mean score remained the same from pretest to posttest for perceptions of raw milk and pasteurized milk having the same overall health value.

Research Question 5: Evaluate participants' satisfaction with the dairy farm visit.

Conclusion: The vast majority of the participants were satisfied with the dairy farm visit.

Support: 87.5% of the participants in this study demonstrated agreement or strong agreement when asked the following items: if the dairy visit taught them something they did not know prior to the visit, if the dairy visit motivated them to buy more dairy products in the future, and if their perspective of the dairy industry is more positive because of this visit. 100% of the participants in this study demonstrated agreement or strong agreement when asked the following items: if they would recommend this dairy visit to others, and if all their questions about the dairy industry were answered on the dairy visit.

Recommendations for Future Research

Additional research regarding the consumer perceptions of the dairy industry, particularly among Generation Z, and how farm visits may positively influence consumer perceptions is highly recommended. This is supported by the finding that 100% of the participants in this study reported that they would recommend a dairy farm visit to others. The instrument developed for this study may also be useful for understanding consumer perceptions or as a benchmark-type survey for dairy farmers to measure the success of their own farm visits over time.

Measuring satisfaction levels of every participant is suggested, as it is an essential component to the success of dairy farm visits. If participants did not enjoy their dairy farm visit, organizers should be made aware of that fact and changes could potentially be made to improve them, if necessary. It is recommended that organizers of dairy farm visits seek feedback from participants, potentially by asking a question such as, "Please describe what you would change about this dairy farm visit, if anything". This feedback could be valuable for improving dairy farm visits and making them successful consumer education tools.

Additional studies would be valuable for the dairy industry, dairy farmers, and agritourism in general. Researchers should focus on ways to have a more expansive set of participants, thus leading to a stronger and more diverse dataset that would be more representative of Generation Z consumers. Although this was a small study of 8 participants, the instrument was found to be valid and reliable. A larger group of study participants would allow researchers to identify and compute any potential factors thereby strengthening the measurement of consumer perceptions. A minimum suggested sample of 100 consumers is suggested for principal components analysis (Gorsuch, 1993; Kline, 1979; MacCallum, Widaman, Zhang & Hong, 1999).

LIST OF REFERENCES

A Brief History of Agritourism, Internationally and in the United States. (2013). In *Colorado Cultural, Heritage and Agritourism Strategic Plan*.

Barbieri, C. (2013). Assessing the sustainability of agritourism in the US: a comparison between agritourism and other farm entrepreneurial ventures. *Journal Of Sustainable Tourism*, *21*(2), 252-270. http://dx.doi.org/10.1080/09669582.2012.685174

Barkema, A. (1993, December). Reaching consumers in the twenty-first century: the short way around the barn. *American Agricultural Economics Association. Issue 75,* 1126-1131.

Boogaard, B. K., Bock, B. B., Oosting, S. J., Wiskerke, J. S. C. & van der Zijpp, A. J. (2011). Social acceptance of dairy farming: The ambivalence between the two faces of modernity. *Journal Agriculture Environmental Ethics, Issue 24,* 259-282. doi: 10.1007/s10806-010-9256-4

Brodt, S., Feenstra, G., Kozloff, R., Klonsky, K., & Tourte, L. (2006). Farmer-Community Connections and the Future of Ecological Agriculture in California. *Agriculture And Human Values, 23*(1), 75-88. http://dx.doi.org/10.1007/s10460-004-5870-y

Bulut, Z., Kökalan Çımrin, F., & Doğan, O. (2017). Gender, generation and sustainable consumption: Exploring the behaviour of consumers from Izmir, Turkey. *International Journal Of Consumer Studies*, *41*(6), 597-604. http://dx.doi.org/10.1111/ijcs.12371

Campbell, D. T. & Stanley, J. C. (1963). *Experimental and quasi-experimental designs for research*. Boston, MA: Houghton Mifflin.

Che, D., Veeck, A., & Veeck, G. (2005). Sustaining production and strengthening the agritourism product: Linkages among Michigan agritourism destinations. *Agriculture And Human Values*, *22*(2), 225-234. http://dx.doi.org/10.1007/s10460-004-8282-0

Clark, J., & Ohkawa, H. (2005). *New discoveries in agrochemicals*. Washington: DC.

Colton, D. & Covert, R. W. (2007). *Designing and constructing instruments for social research and evaluation*. San Fransisco, CA: John Wiley & Sons, Inc.

Croney, C. C. & Anthony, R. (2011). Invited review: Ruminated conscientiously: Scientific and socio-ethical challenges for US dairy production. *Journal of Dairy Science, Issue 94,* 539-546. doi: 10.3168/jds.2010-3627

Davis, J. A. (1971). *Elementary survey analysis,* Englewood, NJ: Prentice-Hall.

de Graff, S., Van Loo, E., Bijttebier, J., Vanhonacker, F., Lauwers, L., Tuyttens, F.A.M., & Verbeke, W. (2016). Determinants of consumer intention to purchase animal-friendly milk. *Journal of Dairy Science, Issue 99,* 8304-8313. Retrieved from http://dx.doi.org/10.3168/jds.2016-10886

Fosnot, C. (2005). *Constructivism* (2nd ed., pp. 8-35). New York: Teachers College Press.

Fromm, J. (2018). *How much Financial Influence does Gen Z have? Forbes*. Retrieved 22 January 2018, from https://www.forbes.com/sites/jefffromm/2018/01/10/what-you-need-to-know-about-the-financial-impact-of-gen-z-influence/#5bb960f256fc

Gorsuch, R. L. (1983). *Factor analysis (2nd ed.).* Hillsdale,NJ: Erlbaum.

Hradiska, E. (2013). Identity and Consumer Behavior of the Generation Z. *Marketing Identity*, 199-214.

IBM Corp. (2017). IBM SPSS Statistics for Windows, Version 25.0. Armonk, NY: IBM Corp.

Igel, C., & Urquhart, V. (2012). Generation Z, Meet Cooperative Learning. *Middle School Journal*, *43*(4), 16-21. http://dx.doi.org/10.1080/00940771.2012.11461816

Kesse-Guyot, E., Péneau, S., Méjean, C., Szabo de Edelenyi, F., Galan, P., Hercberg, S., & Lairon, D. (2013). Profiles of Organic Food Consumers in a Large Sample of French Adults: Results from the Nutrinet-Santé Cohort Study. *Plos ONE, 8*(10), e76998. http://dx.doi.org/10.1371/journal.pone.0076998

Kline, P. (1979). *Psychometrics and psychology*. London, England: Acaderric Press.

MacCallum, R. C., Widaman, K. F., Zhang, S., & Hong S. (1999). Sample size in factor analysis. *Psychological Methods, Issue 4*, 84-99.

National Agricultural Law Center. (2018). *Agritourism Overview*. Retrieved 3 April 2018, from http://nationalaglawcenter.org/overview/agritourism/

Nyikos, M., & Hashimoto, R. (1997). Constructivist Theory Applied to Collaborative Learning in Teacher Education: In Search of ZPD. *The Modern Language Journal*, *81*(4), 506. http://dx.doi.org/10.2307/328893

Olynk, N. J. & Ortega, D. L. (2013). Consumer preferences for verified dairy cattle management practices in processed dairy products. *Food Control, Issue 30*, 298-305. Received from http://dx.doi.org/10.1016/j.foodcont.2012.07.030

Our Food Link. (2018). *Fb.org*. Retrieved 2 April 2018, from https://www.fb.org/programs/womens-leadership-program/our-food-link/

Parr, D., & Van Horn, M. (2006). Development of Organic and Sustainable Agricultural Education at the University of California, Davis: a Closer Look at Practice and Theory. *Hortechnology, 16*(3)

Patton, M. Q. (2006). Evaluation for the way we work. *The Nonprofit Quarterly*, *13 (1),* 28–33.

Personality Traits of Millennials: How to Market to this Generation | Morris Creative Group. (2018). *Morris Creative Group*. Retrieved 3 April 2018, from https://www.morriscreative.com/personality-traits-millennials-market-generation/

Priporas, C., Stylos, N., & Fotiadis, A. (2017). Generation Z consumers' expectations of interactions in smart retailing: A future agenda. *Computers In Human Behavior*, *Issue 77*, 374-381. Retrieved from: http://dx.doi.org/10.1016/j.chb.2017.01.058

Powell, D., & Trexler, C. (2008). Agricultural Literacy: Clarifying a Vision for Practical Application. *Journal Of Agricultural Education*, *49*(1), 85-98.

Reed, A. (2015). Snared: Ethics and Nature in Animal Protection. *Ethnos*, *82*(1), 68-85. Retrieved from: http://dx.doi.org/10.1080/00141844.2015.1028563

Schilling, B., Attavanich, W., & Jin, Y. (2014). Does Agritourism Enhance Farm Profitability?. *Journal Of Agricultural And Resource Economics*, *39*(1), 69-87.

Shatto, B., & Erwin, K. (2016). Moving on From Millennials: Preparing for Generation Z. *The Journal Of Continuing Education In Nursing*, *47*(6), 253-254. http://dx.doi.org/10.3928/00220124-20160518-05

Slama, M., & Tashchian, A. (1985). Selected Socioeconomic and Demographic Characteristics Associated with Purchasing Involvement. *Journal Of Marketing*, *49*(1), 72. http://dx.doi.org/10.2307/1251177

Silva, S., Machado, J., & Cruz, M. (2017). The influence of WOM and Peer Interaction in the Decision-Making Process of Generation Z within the family. *International Journal Of Marketing Communication And New Media*, *2*(2).

Talbert, B. A., & Larke, A., Jr. (1995). Factors influencing minority and non-minority students to enroll in an introductory agriscience course in Texas. *Journal of Agricultural Education, 36*(1), 38-45.

Talbert, B. A. (1996, December). Attitudes toward agriculture of urban students enrolled in high school agricultural education by gender and ethnicity. *Proceedings of the 1996 National Agricultural Education Research Meeting: Partnerships for Success Through Research in Agricultural Education*, Cincinnati, Ohio.

Talbert, B. A. (1997, December). Comparison of attitudes toward agriculture of urban high school students by agricultural education enrollment status, minority status, and gender. *Proceedings of the 24th Annual National Agricultural Education Research Meeting*, Las Vegas, Nevada

Tew, C., & Barbieri, C. (2012). The perceived benefits of agritourism: The provider's Perspective. *Tourism Management, 33*(1), 215-224. Retrieved from: http://dx.doi.org/10.1016/j.tourman.2011.02.005

USDA ERS - Dairy Data. (2018). *Ers.usda.gov*. Retrieved 2 March 2018, from https://www.ers.usda.gov/data-products/dairy-data/

Ventura, B. A. Animal welfare concerns and values of stakeholders within the dairy industry. *Journal of Agricultural and Environmental Ethics, 28(1),* 109-126. Retrieved September 30, 2016, from http://apps.webofknowledge.com.proxy.lib.utk.edu:90/full_record.do?product=UA&seach_mode=GeneralSearch&qid=8&SID=3EJww2MPmVRNysSumzz&page=5&doc=49

Ventura B. A., von Keyserlingk M. A. G., Wittman H., Weary D. M. (2016). What Difference Does a Visit Make? Changes in Animal Welfare Perceptions after Interested Citizens Tour a Dairy Farm. (2013, October). Invited review: Sustainability of the US dairy industry. *Journal of Dairy Science, 96(9),* 5405-5425. Retrieved October 01, 2016, from http://apps.webofknowledge.com.proxy.lib.utk.edu/90/full_record.do?product=UA&search_mode=GeneralSearch&qid=5&SID=3EJww2MPmVRNysSumzz&page=1&doc=7

Verain, M., Bartels, J., Dagevos, H., Sijtsema, S., Onwezen, M., & Antonides, G. (2012). Segments of sustainable food consumers: a literature review. *International Journal Of Consumer Studies*, *36*(2), 123-132. http://dx.doi.org/10.1111/j.1470-6431.2011.01082.x

Verbeke, W. (2006). Functional foods: Consumer willingness to compromise on taste for health?. *Food Quality And Preference*, *17*(1-2), 126-131. http://dx.doi.org/10.1016/j.foodqual.2005.03.003

von Keyserlingk, M., Martin, N., Kebreab, E., Knowlton, K., Grant, R., & Stephenson, M. (2013). Invited review: Sustainability of the US dairy industry. *Journal Of Dairy Science*, *96*(9), 5405-5425. http://dx.doi.org/10.3168/jds.2012-6354

Walsh, G., & Mitchell, V. (2005). Demographic characteristics of consumers who find it difficult to decide. *Marketing Intelligence & Planning*, *23*(3), 281-295. http://dx.doi.org/10.1108/02634500510597319

Weinrich, R., Kuhl, S., Zuhlsdorf, A., & Spiller, A. (2014). Consumer attitudes in Germany towards different dairy housing systems and their implications for the marketing of pasture raised milk. *International Food and Agribusiness Management Review,* 17(4), 205

Williams, A. (2018). *Move Over, Millennials, Here Comes Generation Z. Nytimes.com.* Retrieved 4 April 2018, from https://www.nytimes.com/2015/09/20/fashion/move-over-millennials-here-comes-generation-z.html

Wolf, C. A. (2016, July). Public and farmer perceptions of dairy cattle welfare in the United States. Journal of Dairy Science, 99(7), 5892-5903. Retrieved October 01, 2016, from

http://apps.webofknowledge.com.proxy.lib.utk.edu:90/full_record.do?product=UA&seach_mode=GeneralSearch&qid=1&SID=3EJww2MPmVRNysSumzz&page=1&doc=7

15 Consumer Behaviors Setting 5 Generations Apart Precision Dialogue. (2018). *Precision Dialogue*. Retrieved 3 April 2018, from http://www.precisiondialogue.com/generations-consumer-behaviors/

(2018). *Wmfc.org*. Retrieved 3 April 2018, from http://www.wmfc.org/uploads/GenerationalDifferencesChart.pdf

APPENDICES

Appendix A: Talking Points Script

Parlor:

- Antibiotic usage/rules
- Inspections and parlor rules
- Parlor protocols and steps
- Animal care protocols
- Dairy product regulations
- SCC counts and incentive programs
- Raw milk vs. pasteurized

Calves:

- Genetics, breeding
- Advantages of A.I.
- Pregnancy, dry cows, reproductive cycle
- Research rules and goals of studies
- Bull calves, calf separation
- Colostrum

Barn/Manure Management:

- Hoof trimmings: benefits and reasons behind them
- Herd health, nutrition
- Cow enrichment (scratchers), animal welfare
- Cow comfort
- Manure management, low environmental impact
- Regular barn/bed cleanings and why

Appendix B: Pretest

THE UNIVERSITY OF TENNESSEE KNOXVILLE

UTCASNR INSTITUTE OF AGRICULTURE

Analyzing Students' Perceptions of the Dairy Industry through Dairy Farm Visits at the University of Tennessee: A Convenience Sample Approach

PRE-TEST

Part 1: Herd Health

1. Dairy farmers schedule annual hoof trimmings to help prevent cows from becoming lame and being in pain.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
O	O	O	O	O

2. Dairy farmers do not care about the overall health of their cows.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
O	O	O	O	O

3. Dairy cows are constantly being genetically altered.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
O	O	O	O	O

4. Dairy farms offer enrichment (such as cow scratchers) and other aspects to have a high level of animal welfare.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
O	O	O	O	O

5. Dairy farmers ask for help from nutritionists to make sure the cows are eating quality diets.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

IRB NUMBER: UTK IRB-17-04064-XP
IRB APPROVAL DATE: 01/17/2018

1

○	○	○	○	○

6. Dairy cows are always pregnant and never given a break from milking.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
○	○	○	○	○

7. Dairy cows are only given antibiotics when they are ill and in need of them.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
○	○	○	○	○

8. Dairy cows are uncomfortable because they stand for most their days.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
○	○	○	○	○

Part 2: Dairy Regulations

1. Animal inspectors visit dairy farms on a regular basis to make sure no animals are being abused.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
○	○	○	○	○

2. Dairy farm employees do not have protocols to follow or training before they begin working on the farm.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
○	○	○	○	○

3. Dairy products are highly regulated agricultural products.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
○	○	○	○	○

IRB NUMBER: UTK IRB-17-04064-XP
IRB APPROVAL DATE: 01/17/2018

4. If antibiotics are found in a farm's milk, the whole tank will be thrown out and not sold to a processing plant.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
O	O	O	O	O

5. New research is constantly looking for ways to improve milk quality.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
O	O	O	O	O

6. Farmers conserve the environment and want to have the smallest negative impact possible.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
O	O	O	O	O

7. There are no regulations on manure management for dairy farms.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
O	O	O	O	O

8. Incentive monetary programs are offered to farms with lower Somatic Cell Counts (white blood cells in milk) suggesting that their cows are generally, healthier.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
O	O	O	O	O

Part 3: Farm Practices

1. Raw milk is healthier than pasteurized milk.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

○	○	○	○	○

2. Only female dairy calves are useful on the farm.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
○	○	○	○	○

3. Dairy calves are removed from their mothers, thus receiving poor nutrition.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
○	○	○	○	○

4. Dairy barns are cleaned at least once a day while the bedding is cleaned 2 to 3 times each day.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
○	○	○	○	○

5. Dairy farmers want to keep things as clean as possible to limit the spread of disease and provide high quality milk.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
○	○	○	○	○

6. Because milking parlors are dirty, bacteria will get into the milk.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
○	○	○	○	○

7. Milking employees follow sanitizing protocols like: wearing new gloves for each shift and disinfecting the cow's udders.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
○	○	○	○	○

8. Dairy cattle live in their own waste on a constant basis.

IRB NUMBER: UTK IRB-17-04064-XP
IRB APPROVAL DATE: 01/17/2018

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
O	O	O	O	O

9. Newborn dairy calves are fed colostrum to help jump start their immune systems.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
O	O	O	O	O

Part 4: Demographic Info

1. I grew up _____.

   A. On a farm or ranch that my parents/guardians own, manage, or work

   B. In a rural area, but not on a farm or ranch

   C. In a small town of 5,000 people or fewer

   D. In a small city or suburb with a population greater than 5,000 but fewer than 50,000 people

   E. In an urban area OR a large city of more than 50,000 people

2. My gender is ____.

   A) Male

   B) Female

   C) Prefer not to say

3. I am _____ years old.

   A) 18

   B) 19

   C) 20

   D) 21

   E) 22

   F) 23 or older

4. Have you ever been to a working dairy farm?

   A) Yes

   B) No

5. I am in an agriculture-related program.

A) Yes

B) No

6. Growing up, were you ever involved in 4-H?

A) Yes

B) No

7. Growing up, were you ever involved in FFA?

A) Yes

B) No

8. Growing up, were you ever involved in a school-related agriculture-related program?

A) Yes

B) No

Appendix C: Posttest

THE UNIVERSITY OF TENNESSEE KNOXVILLE

UTCASNR INSTITUTE OF AGRICULTURE THE UNIVERSITY OF TENNESSEE

Analyzing Students' Perceptions of the Dairy Industry through Dairy Farm Visits at the University of Tennessee: A Convenience Sample Approach

POST-TEST

Part 1: Herd Health

1. Dairy farmers schedule annual hoof trimmings to help prevent cows from becoming lame and being in pain.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
O	O	O	O	O

2. Dairy farmers do not care about the overall health of their cows.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
O	O	O	O	O

3. Dairy cows are constantly being genetically altered.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
O	O	O	O	O

4. Dairy farms offer enrichment (such as cow scratchers) and other aspects to have a high level of animal welfare.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
O	O	O	O	O

IRB NUMBER: UTK IRB-17-04064-XP
IRB APPROVAL DATE: 01/17/2018

5. Dairy farmers ask for help from nutritionists to make sure the cows are eating quality diets.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
O	O	O	O	O

6. Dairy cows are always pregnant and never given a break from milking.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
O	O	O	O	O

7. Dairy cows are only given antibiotics when they are ill and in need of them.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
O	O	O	O	O

8. Dairy cows are uncomfortable because they stand for most their days.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
O	O	O	O	O

Part 2: Dairy Regulations

1. Animal inspectors visit dairy farms on a regular basis to make sure no animals are being abused.

IRB NUMBER: UTK IRB-17-04064-XP
IRB APPROVAL DATE: 01/17/2018

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
○	○	○	○	○

2. Dairy farm employees do not have protocols to follow or training before they begin working on the farm.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
○	○	○	○	○

3. Dairy products are highly regulated agricultural products.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
○	○	○	○	○

4. If antibiotics are found in a farm's milk, the whole tank will be thrown out and not sold to a processing plant.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
○	○	○	○	○

5. New research is constantly looking for ways to improve milk quality.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
○	○	○	○	○

6. Farmers conserve the environment and want to have the smallest negative impact possible.

IRB NUMBER: UTK IRB-17-04064-XP
IRB APPROVAL DATE: 01/17/2018

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
O	O	O	O	O

7. There are no regulations on manure management for dairy farms.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
O	O	O	O	O

8. Incentive monetary programs are offered to farms with lower Somatic Cell Counts (white blood cells in milk) suggesting that their cows are generally, healthier.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
O	O	O	O	O

Part 3: Farm Practices

1. Raw milk is healthier than pasteurized milk.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
O	O	O	O	O

2. Only female dairy calves are useful on the farm.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
O	O	O	O	O

3. Dairy calves are removed from their mothers, thus receiving poor nutrition.

IRB NUMBER: UTK IRB-17-04064-XP
IRB APPROVAL DATE: 01/17/2018

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
O	O	O	O	O

4. Dairy barns are cleaned at least once a day while the bedding is cleaned 2 to 3 times each day.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
O	O	O	O	O

5. Dairy farmers want to keep things as clean as possible to limit the spread of disease and provide high quality milk.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
O	O	O	O	O

6. Because milking parlors are dirty, bacteria get into the milk.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
O	O	O	O	O

7. Milking employees follow sanitizing protocols like: wearing new gloves for each shift and disinfecting the cow's udders.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
O	O	O	O	O

8. Dairy cattle live in their own waste on a constant basis.

IRB NUMBER: UTK IRB-17-04064-XP
IRB APPROVAL DATE: 01/17/2018

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
O	O	O	O	O

9. Newborn dairy calves are fed colostrum to help jump start their immune systems.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
O	O	O	O	O

Part 4: Satisfaction

1. This dairy farm visit taught me something I did not know before.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
O	O	O	O	O

2. This visit has motivated me more to buy dairy products.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
O	O	O	O	O

3. I would recommend a dairy farm visit to others.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
O	O	O	O	O

4. My questions about the dairy industry were answered today.

IRB NUMBER: UTK IRB-17-04064-XP
IRB APPROVAL DATE: 01/17/2018

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
○	○	○	○	○

5. My perspective on the dairy industry is more positive because of this visit.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
○	○	○	○	○

IRB NUMBER: UTK IRB-17-04064-XP
IRB APPROVAL DATE: 01/17/2018

Appendix D: Consent Form

Informed Consent Statement

Analyzing Students' Perceptions of the Dairy Industry through Dairy Farm Visits at the University of Tennessee: A Convenience Sample Approach

Introduction: You are invited to participate in a **research** study. This research seeks to understand if consumers' opinions change after visiting an operating dairy farm and getting the opportunity to ask farmers questions about cow welfare and the dairy industry. We are evaluating the value of dairy farm visits as they relate to consumers' perceptions regarding milk and dairy farming.

Information about Participants' Involvement in the Study: You will participate in an educational tour of the Little River Animal and Environmental Unit, a University of Tennessee research and teaching farm that includes a dairy operation. You must be 18 years or older and you should be able to stand and walk easily for 90 minutes. Before the tour, you will complete a pre-test to measure your opinions about milk consumption and dairy production. After the tour, you will complete a post-test regarding how your perceptions may or may not have changed due to the tour. The three topic sections will be:

- Dairy Herd Health
- Dairy Farm Practices
- Dairy Regulations

As the Little River Animal and Environmental Unit is a research and teaching farm, you agree not to take pictures or post to social media regarding your visit as the farm may use technologies that are proprietary in nature. In addition, you are not permitted to take any pictures or post to social media during the visit to protect the confidentiality of all study participants.

Duration of the Study: The study will take approximately three hours. Transportation will be provided to and from the Little River Animal and Environmental Unit and transportation will depart from the UT Agriculture Campus.

Risks: There are no foreseeable risks associated with your participation in this study other than those encountered in everyday life.

Benefits: This study will help to determine the effectiveness of dairy farm visits and educational tours for consumers and the results may inform future educational tours. You may gain more knowledge of the dairy industry and learn about dairy farming practices.

IRB NUMBER: UTK IRB-17-04064-XP
IRB APPROVAL DATE: 12/04/2017

Voluntary Participation: The participation in this study is voluntary and withdrawal from the study is permitted at any time without any repercussions. Not participating in the study or withdrawing from the study will not result in loss of benefit or have any impact on the course grade. If you withdraw from the study before data collection is completed your data will not be saved, and it will be omitted from the study results.

Confidentiality: Data and records will be kept confidential by the researchers. Data will be stored securely and will be made available only to persons conducting the study. NO reference will be made in oral or written reports which could link participants to the study. Records will be stored in a locked file cabinet on the University of Tennessee campus in Knoxville, Tennessee for three years. While the pre-test and post-test will ask for your name, we will delete your name from our records and only use numbers to identify participants when we analyze the data collected.

Contact Information: If you have questions at any time about the study or the procedures, (or you experience adverse effects as a result of participating in this study,) you may contact the researchers, Ms. Erin Allen at eallen24@vols.utk.edu or Dr. Joseph L. Donaldson, University of Tennessee, Agricultural Leadership, Education and Communications, at jdonaldson@tennessee.edu, 865-974-7371 or Dr. Gina Pighetti, University of Tennessee, Animal Science, pighetti@utk.edu, 865-974-7225. If you have questions about your rights as a participant, you may contact the University of Tennessee IRB Compliance Officer at utkirb@utk.edu or 865-974-7697.

Consent: I have read and understand the above explanation in regard to my participation in this study. I also recognize that I will not be permitted to take pictures/ post to social media and have been given an opportunity to ask any questions about the study. I agree to participate.

Name of Participant (print) _____ Date_____

Name of Participant (signature) _____

Researcher Signature _____ Date _____

IRB NUMBER: UTK IRB-17-04064-XP
IRB APPROVAL DATE: 12/04/2017

Appendix E: Cover Letter

THE UNIVERSITY OF TENNESSEE KNOXVILLE

UTCASNR INSTITUTE OF AGRICULTURE

Analyzing Students' Perceptions of the Dairy Industry through Dairy Farm Visits at the University of Tennessee: A Convenience Sample Approach

Dear Student,

You are invited to participate in a research study. This research seeks to understand if consumers' opinions change after visiting an operating dairy farm and getting the opportunity to ask farmers questions about cow welfare and the dairy industry. We are evaluating the value of dairy farm visits as they relate to consumers' perceptions regarding milk and dairy farming.

If you agree to participate in this research, you will take part in an educational tour of the Little River Animal and Environmental Unit, a University of Tennessee research and teaching farm that includes a dairy operation. You must be 18 years or older and you should be able to stand and walk easily for 90 minutes. Before the tour, you will complete a pre-test to measure your opinions about milk consumption and dairy production. After the tour, you will complete a post-test regarding how your perceptions may or may not have changed due to the tour. Transportation will be provided to and from the Little River Animal and Environmental Unit at no cost to you. The entire research study will take approximately three hours. If you chose to participate, please sign the attached consent form, and return it to us at the meeting time listed below.

- Date – Wednesday, January 24, 2018
- Time – 7:30 AM
- Location – Outside Food Science Building

Your participation in this study is voluntary and withdrawal from the study is permitted at any time without any repercussions. Not participating in the study or withdrawing from the study will not result in loss of benefit or have any impact on the course grade. If you withdraw from the study before data collection is completed your data will not be saved, and it will be omitted from the study results. Data and records will be kept confidential by the researchers. There is no monetary compensation for participating in this study.

If you have any questions about this study, you may contact the researchers, Ms. Erin Allen at eallen24@vols.utk.edu or Dr. Joseph L. Donaldson, University of Tennessee, Agricultural Leadership, Education and Communications, at jdonaldson@tennessee.edu, 865-974-7371 or Dr. Gina Pighetti, University of Tennessee, Animal Science, pighetti@utk.edu, 865-974-7225. If you have questions about your rights as a participant, you may contact the University of Tennessee IRB Compliance Officer at utkirb@utk.edu or 865-974-7697. Thank you.

Sincerely,

Erin Allen, B.S.
M.S. Candidate
Agricultural Leadership, Education, and Communications
Email: eallen24@vols.utk.edu

IRB NUMBER: UTK IRB-17-04064-XP
IRB APPROVAL DATE: 12/04/2017

Appendix F: IRB Correspondences

THE UNIVERSITY OF TENNESSEE KNOXVILLE

December 04, 2017

Erin Nicole Allen,
UTIA - UTIA - 4-H Youth Development

Re: UTK IRB-17-04064-XP
Study Title: Analyzing the Public's Perception of the dairy Industry Through Dairy Farm Visits

Dear Erin Nicole Allen:

The UTK Institutional Review Board (IRB) reviewed your application for the above referenced project. It determined that your application is eligible for expedited review under 45 CFR 46.110(b)(1), category (7). The IRB has reviewed these materials and determined that they do comply with proper consideration for the rights and welfare of human subjects and the regulatory requirements for the protection of human subjects.

Therefore, this letter constitutes full approval by the IRB of your application (version 1.2) as submitted, including Main Informed Consent - (Version 3.0), Cover Letter - (Version 1.1), Post-Test - (Version 1.0), and the Pre-Test - (Version 1.0). The listed documents have been dated and stamped IRB approved. Approval of this study will be valid from December 04, 2017 to December 03, 2018.

In the event that subjects are to be recruited using solicitation materials, such as brochures, posters, web-based advertisements, etc., these materials must receive prior approval of the IRB. Any revisions in the approved application must also be submitted to and approved by the IRB prior to implementation. In addition, you are responsible for reporting any unanticipated serious adverse events or other problems involving risks to subjects or others in the manner required by the local IRB policy.

Finally, re-approval of your project is required by the IRB in accord with the conditions specified above. You may not continue the research study beyond the time or other limits specified unless you obtain prior written approval of the IRB.

Sincerely,

Colleen P. Gilrane

Colleen P. Gilrane, Ph.D.
Chair

Institutional Review Board | Office of Research & Engagement
1534 White Avenue Knoxville, TN 37996-1529
865-974-7697 865-974-7400 fax irb.utk.edu

January 17, 2018

Erin Nicole Allen,
UTIA - UTIA - 4-H Youth Development

Re: UTK IRB-17-04064-XP
Study Title: Analyzing the Public's Perception of the dairy Industry Through Dairy Farm Visits

Dear Dr. Allen:

The UTK Institutional Review Board (IRB) reviewed your application for **revision** of your previously approved project, referenced above.

The IRB determined that your application is eligible for **expedited** review under 45 CFR 46.110(b)(2). The following revisions were approved as complying with proper consideration of the rights and welfare of human subjects and the regulatory requirements for the protection of human subjects:

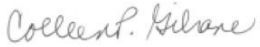
- **Approved Changes:** change in the title of both pre and post test.
- **Approved Documents:**
    - Post test 1.10.18 v2.0
    - Pre test 1.10.18 v2.0

Approval does not alter the expiration date of this project, which is 12/03/2018.

In the event that subjects are to be recruited using solicitation materials, such as brochures, posters, web-based advertisements, etc., these materials must receive prior approval of the IRB. Any revisions in the approved application must also be submitted to and approved by the IRB prior to implementation. In addition, you are responsible for reporting any unanticipated serious adverse events or other problems involving risks to subjects or others in the manner required by the local IRB policy.

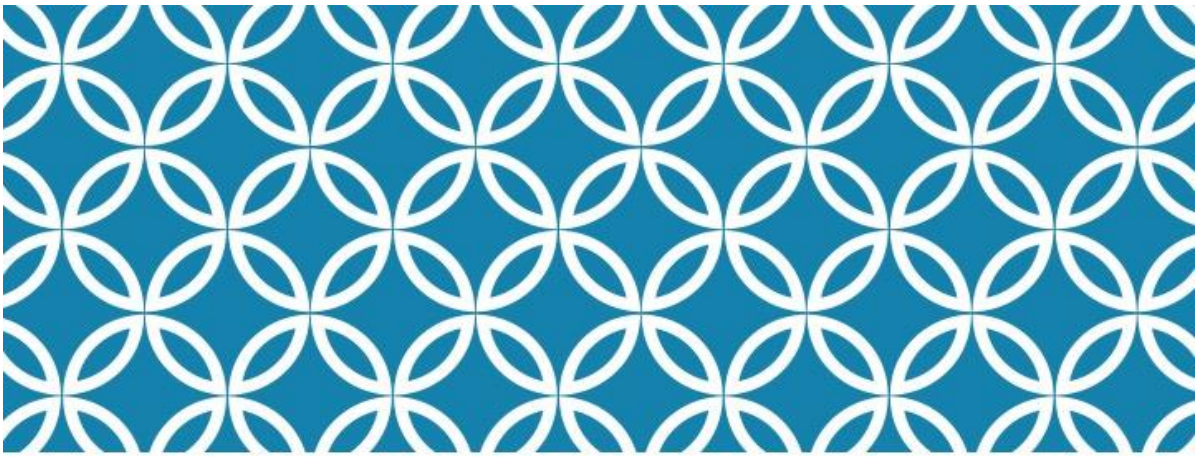
Finally, **re-approval** of your project is required by the IRB in accord with the conditions specified above. You may not continue the research study beyond the time or other limits specified unless you obtain prior written approval of the IRB.

Sincerely,



Colleen P. Gilrane, Ph.D.
Chair

Appendix G: Dairy Farming Presentation



DAIRY FARMING | A quick look

DAIRY FARMING

- In the U.S., 21 billion gallons of milk are produced annually
- All 50 states have dairy farms
- 98% of U.S. dairy farms are family owned and operated
- Dairy farms, trucking companies and processing facilities are responsible for 900,000 jobs annually
- 9.31 million dairy cows in the United States
- 60,000 dairy farms in the U.S.

DAIRY COWS

- Dairy cows are ruminants, meaning they regurgitate their food to re-chew for breakdown of forages
- Average dairy cows weigh about 1400 pounds
- There are six popular breeds of dairy cows
- Just like humans, cows must have a calf in order to produce milk

MAIN GOAL OF DAIRY FARMERS

To keep their cows healthy and happy while creating a nutritious, healthy product for consumers.

NUTRITION

- Each cow eats about 100 lbs. of food and drinks 50 gallons of water each day
- Farmers work with veterinarians and nutritionists to develop precise rations for their cows, depending on their age, stage of lactation and overall health
- Putting high quality components in, leads to a high quality product being produced

MILK QUALITY

- Farmers watch closely for any signs that a cow is sick or hurt, because that can influence the quality of the milk that she produces
- Research is continuing to find out more about factors that can influence the quality of the milk and contribute to healthier cows

SANITATION

- Cow beds and barns are cleaned 1-3 times each day, to maintain positive herd health
- Strict regulations are in place to make sure that farmers are managing manure in the safe way

COW COMFORT

- The more comfortable cows are, the more milk they produce
- Farmers provide enough space for cows to lay in order to rest as much as they like
- Many farms offer cow enrichment (scratchers)

MILKING

- Cows are milked 2-3 times each day, depending on the farm
- Employees are trained in proper sanitation and milking parlor protocols to keep bacteria from spreading

DAIRY CALVES

- When born, calves weigh about 90 lbs.
- Housed individually usually to cut down on the spread of disease
- Calf's immune system is immature at birth

THIS DAIRY

Since this is a research farm as well as a functioning dairy, some things will be slightly different on our tour today

The research conducted at this farm is vital to the success of the dairy industry and to improve the health of dairy cattle

GROUPS

We are now going to split the class up into three even groups!

Table 8: Correlation Matrix

	Herd Health 1	Herd Health 2	Herd Health 3	Herd Health 4	Herd Health 5	Herd Health 6	Herd Health 7	Herd Health 8
Herd Health 1	1.000	0.265	-0.137	-0.006	0.390	0.351	0.261	0.021
Herd Health 2	0.265	1.000	-0.100	0.165	0.451	0.262	0.129	0.354
Herd Health 3	-0.137	-0.100	1.000	-0.189	-0.274	-0.337	-0.222	-0.100
Herd Health 4	-0.006	0.165	-0.189	1.000	0.408	0.281	0.269	0.389
Herd Health 5	0.390	0.451	-0.274	0.408	1.000	0.557	0.258	0.387
Herd Health 6	0.351	0.262	-0.337	0.281	0.557	1.000	0.410	0.330
Herd Health 7	0.261	0.129	-0.222	0.269	0.258	0.410	1.000	0.311
Herd Health 8	0.021	0.354	-0.100	0.389	0.387	0.330	0.311	1.000
Dairy Reg 1	0.336	0.433	-0.334	0.283	0.624	0.552	0.253	0.492
Dairy Reg 2	0.220	0.292	0.046	0.201	0.491	0.381	0.136	0.144
Dairy Reg 3	0.289	0.421	-0.261	0.349	0.543	0.381	0.246	0.266
Dairy Reg 4	0.339	0.320	-0.162	0.235	0.105	0.456	0.576	0.079
Dairy Reg 5	0.207	0.247	-0.325	0.244	0.438	0.451	0.310	0.298
Dairy Reg 6	0.141	0.214	-0.061	0.274	0.056	0.033	0.308	0.278
Dairy Reg 7	0.157	0.275	-0.264	0.347	0.413	0.273	0.311	0.258
Dairy Reg 8	0.202	0.165	-0.067	0.434	0.368	0.248	0.242	0.144
Farm Practices 1	-0.004	-0.157	0.042	0.043	0.249	0.112	0.177	0.121
Farm Practices 2	-0.144	-0.004	-0.199	0.030	0.087	0.232	0.031	0.134
Farm Practices 3	0.149	0.268	-0.341	0.359	0.504	0.597	0.421	0.406
Farm Practices 4	0.011	0.011	-0.358	0.446	0.378	0.248	0.093	0.252
Farm Practices 5	0.282	0.296	-0.141	0.299	0.562	0.389	0.194	0.371
Farm Practices 6	0.247	0.350	-0.341	0.256	0.297	0.372	0.232	0.323
Farm Practices 7	0.294	0.322	-0.316	0.344	0.472	0.301	0.244	0.275
Farm Practices 8	0.313	0.301	-0.361	0.249	0.631	0.584	0.276	0.505
Farm Practices 9	0.298	0.308	-0.213	0.255	0.502	0.417	0.381	0.420

Table 8: Correlation Matrix (continued)

	Dairy Reg 1	Dairy Reg 2	Dairy Reg 3	Dairy Reg 4	Dairy Reg 5	Dairy Reg 6	Dairy Reg 7	Dairy Reg 8
Herd Health 1	0.336	0.220	0.289	0.339	0.207	0.141	0.157	0.202
Herd Health 2	0.433	0.292	0.421	0.320	0.247	0.214	0.275	0.165
Herd Health 3	-0.334	0.046	-0.261	-0.162	-0.325	-0.061	-0.264	-0.067
Herd Health 4	0.283	0.201	0.349	0.235	0.244	0.274	0.347	0.434
Herd Health 5	0.624	0.491	0.543	0.105	0.438	0.056	0.413	0.368
Herd Health 6	0.552	0.381	0.381	0.456	0.451	0.033	0.273	0.248
Herd Health 7	0.253	0.136	0.246	0.576	0.310	0.308	0.311	0.242
Herd Health 8	0.492	0.144	0.266	0.079	0.298	0.278	0.258	0.144
Dairy Reg 1	1.000	0.505	0.521	0.171	0.462	0.199	0.562	0.167
Dairy Reg 2	0.505	1.000	0.621	0.173	0.422	0.065	0.552	0.282
Dairy Reg 3	0.521	0.621	1.000	0.229	0.689	0.147	0.591	0.330
Dairy Reg 4	0.171	0.173	0.229	1.000	0.289	0.332	0.212	0.317
Dairy Reg 5	0.462	0.422	0.689	0.289	1.000	0.378	0.420	0.291
Dairy Reg 6	0.199	0.065	0.147	0.332	0.378	1.000	0.170	0.093
Dairy Reg 7	0.562	0.552	0.591	0.212	0.420	0.170	1.000	0.453
Dairy Reg 8	0.167	0.282	0.330	0.317	0.291	0.093	0.453	1.000
Farm Practices 1	0.179	0.355	0.079	-0.094	-0.107	-0.179	0.312	0.131
Farm Practices 2	0.437	0.131	0.138	-0.035	0.085	0.019	0.314	-0.032
Farm Practices 3	0.542	0.422	0.367	0.404	0.468	0.238	0.388	0.135
Farm Practices 4	0.391	0.224	0.237	0.005	0.331	0.121	0.165	0.100
Farm Practices 5	0.453	0.283	0.486	0.154	0.442	0.071	0.484	0.314
Farm Practices 6	0.442	0.033	0.156	0.193	0.298	0.266	0.180	0.098
Farm Practices 7	0.461	0.229	0.444	0.292	0.408	0.339	0.597	0.420
Farm Practices 8	0.734	0.347	0.435	0.134	0.500	0.249	0.570	0.220
Farm Practices 9	0.428	0.190	0.360	0.502	0.467	0.273	0.372	0.438

Table 8: Correlation Matrix (continued)

	Farm Practices 1	Farm Practices 2	Farm Practices 3	Farm Practices 4	Farm Practices 5	Farm Practices 6	Farm Practices 7	Farm Practices 8
Herd Health 1	-0.004	-0.144	0.149	0.011	0.282	0.247	0.294	0.313
Herd Health 2	-0.157	-0.004	0.268	0.011	0.296	0.350	0.322	0.301
Herd Health 3	0.042	-0.199	-0.341	-0.358	-0.141	-0.341	-0.316	-0.361
Herd Health 4	0.043	0.030	0.359	0.446	0.299	0.256	0.344	0.249
Herd Health 5	0.249	0.087	0.504	0.378	0.562	0.297	0.472	0.631
Herd Health 6	0.112	0.232	0.597	0.248	0.389	0.372	0.301	0.584
Herd Health 7	0.177	0.031	0.421	0.093	0.194	0.232	0.244	0.276
Herd Health 8	0.121	0.134	0.406	0.252	0.371	0.323	0.275	0.505
Dairy Reg 1	0.179	0.437	0.542	0.391	0.453	0.442	0.461	0.734
Dairy Reg 2	0.355	0.131	0.422	0.224	0.283	0.033	0.229	0.347
Dairy Reg 3	0.079	0.138	0.367	0.237	0.486	0.156	0.444	0.435
Dairy Reg 4	-0.094	-0.035	0.404	0.005	0.154	0.193	0.292	0.134
Dairy Reg 5	-0.107	0.085	0.468	0.331	0.442	0.298	0.408	0.500
Dairy Reg 6	-0.179	0.019	0.238	0.121	0.071	0.266	0.339	0.249
Dairy Reg 7	0.312	0.314	0.388	0.165	0.484	0.180	0.597	0.570
Dairy Reg 8	0.131	-0.032	0.135	0.100	0.314	0.098	0.420	0.220
Farm Practices 1	1.000	0.292	0.162	0.036	0.021	-0.064	0.167	0.182
Farm Practices 2	0.292	1.000	0.166	0.079	0.292	0.049	0.216	0.328
Farm Practices 3	0.162	0.166	1.000	0.337	0.312	0.551	0.359	0.617
Farm Practices 4	0.036	0.079	0.337	1.000	0.181	0.337	0.247	0.358
Farm Practices 5	0.021	0.292	0.312	0.181	1.000	0.359	0.614	0.589
Farm Practices 6	-0.064	0.049	0.551	0.337	0.359	1.000	0.427	0.511
Farm Practices 7	0.167	0.216	0.359	0.247	0.614	0.427	1.000	0.526
Farm Practices 8	0.182	0.328	0.617	0.358	0.589	0.511	0.526	1.000
Farm Practices 9	0.054	0.137	0.574	0.186	0.444	0.479	0.561	0.502

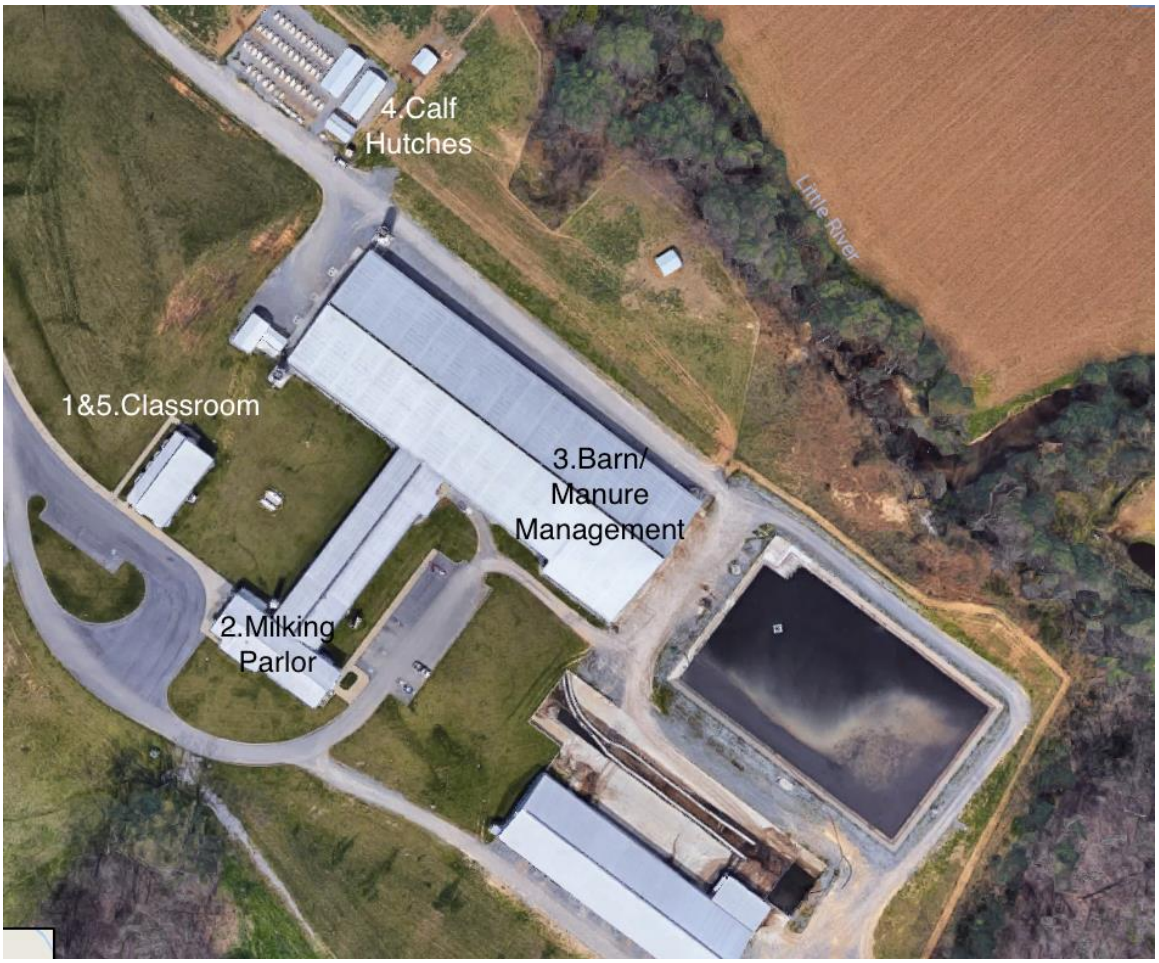


Figure 1. Dairy Farm Stations Map

VITA

Erin N. Allen is a graduate student at the University of Tennessee in Knoxville. Upon completion and approval of this thesis report, she will receive a Master of Science degree in Agricultural Leadership, Education and Communications. Previously, Erin earned a Bachelor of Science degree in Animal Science, also from the University of Tennessee. At the time of writing this thesis report, Erin held a position as a graduate teaching assistant for the Office of Information Technology. There, she assisted students and faculty with troubleshooting issues with Zoom (an online meeting tool). Also during graduate school, Erin worked as a Dairy Extension intern, working with Dr. Peter Krawczel to help coordinate Extension meetings across the state and working on the Southeast Milk Quality Initiative. Prior to graduate school, Erin worked at Cruze dairy farm as a milker and assistant herdsman, also while being on the UT Dairy Challenge team. Upon graduation in May, Erin plans to work in the field of Extension or dairy agritourism in the Knoxville, TN area.